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Remote Work in the Metaverse: How Software Development Teams Experience Gather.Town

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Abstract The remote work model is becoming increasingly established in software companies, driven by the demand for flexibility and the advancement of communication technologies. Despite its benefits, this shift brings challenges, such as asynchronous communication, reduced opportunities for spontaneous interactions, and social isolation. To overcome these obstacles, some development teams are adopting metaverse environments, such as *Gather.Town*. In this context, this research investigates the impact of using metaverse environments on the experience of members of remote software development teams, as well as the factors that influence their adoption and abandonment. We conducted surveys and interviews with 13 practitioners from five software development companies who have used or are currently using *Gather.Town*. The study addressed aspects such as ease of use, communication, collaboration, sense of presence, social interaction, and flow experience, as well as adoption challenges and reasons for abandonment. Our results indicate that metaverse environments can facilitate collaboration in remote software development teams by promoting social interaction, enhancing the sense of presence, and enabling more efficient communication. This helps mitigate some of the limitations of traditional remote work, such as social isolation. However, participants also reported challenges, including distractions caused by playful elements and difficulties with privacy during sensitive interactions. Organizational restrictions were also identified as a barrier that limited the adoption of the platform. This research demonstrates that the use of metaverse environments can enhance communication and collaboration in remote teams. When properly aligned with the team's needs and workflows, these environments offer a more integrated and engaging work experience.

Keywords: *Metaverse, Gather.Town, Developer Experience, Software Development Teams, Remote Work, Flow State, Practitioners Recommendations.*

1 Introduction

The COVID-19 pandemic impacted work worldwide (Diab-Bahman and Al-Enzi, 2020; Lee et al., 2023), forcing companies and teams to adopt remote work. Even after the end of the pandemic, many individuals prefer this model. Reasons include flexibility, eliminated commuting, and greater autonomy (Parker et al., 2022; Bailey and Kurland, 2002). This preference is so strong that many professionals refuse to return to on-site work (Park et al., 2023).

However, despite the benefits of remote work, challenges arise, particularly in the context of software development teams. Asynchronous communication, for example, can lead to delays in information exchange and problem-solving (Ford et al., 2021). In addition, the lack of social interactions can hinder collaboration and creativity at work (Bailey and Kurland, 2002). This absence of interaction may also inhibit the sense of belonging and negatively affect organizational culture (Park et al., 2023). Challenges related to isolation, fatigue, and shifts in productivity have remained consistent since the beginning of remote work (Ford et al., 2021). Another relevant concern is the reduced awareness of colleagues' work (Morrison-Smith and Ruiz, 2020).

Given these challenges, metaverse platforms emerge as a promising alternative to support remote work in software development teams. The term "metaverse", derived from "meta" and "universe", refers to a virtual universe where users interact in real-time through avatars and digital objects (Mystakidis, 2022; Reference, 2024; Kim, 2021). These virtual spaces provide an immersive experience, increasing the sense of reality, presence, and social interaction (Lee et al., 2023) and promoting collaboration (Voinea et al., 2022).

In light of this, this research reports how the use of metaverse environments impacts the experience of professionals in remote software development teams, as well as the factors that influence their adoption and abandonment. To this end, the following specific objectives are proposed:

1. Analyze the perception of software professionals regarding ease of use, presence, flow, communication, and collaboration in the metaverse.
2. Evaluate whether metaverse features promote social interaction among team members.
3. Investigate challenges in using *Gather.Town* [1] and the factors that influence its adoption or abandonment by remote teams.
4. Propose recommendations to improve the adoption and use of *Gather.Town* by remote development teams.

To achieve these objectives, we conducted an empirical study using the *Gather.Town* platform, a metaverse environment. The study involved 13 professionals from five software development companies and was divided into two

[1] https://gather.town/

stages. In the first stage, we conducted surveys and interviews with open and closed questions, addressing aspects such as ease of use, communication, collaboration, presence, and social interaction. The second stage consisted of interviews focusing on participants' perceptions of the flow state and the challenges that may influence the adoption or abandonment of *Gather.Town*. We analyzed the interview data qualitatively and the survey data quantitatively.

The findings indicated that *Gather.Town* provides a stronger sense of presence for remote teams. This, in turn, enhances communication and fosters a more informal environment, facilitating collaboration among team members. Additionally, the findings revealed indications of experiencing flow, particularly during the quick resolution of questions. These moments supported task continuity by enabling immediate feedback, intense concentration, and, in some cases, a loss of time awareness. On the other hand, frequent interruptions, privacy concerns, organizational restrictions, and the cost of the premium version negatively affected professionals' experiences and hindered continuous use. In some cases, these factors led to the abandonment of the tool.

The contribution of this work is threefold. First, we provide empirical evidence that metaverse environments, such as Gather.Town, can enhance social interaction, presence, communication, and collaboration in remote software development teams. Second, we identify both enablers and barriers to the experience of flow in these environments, highlighting the role of immediate communication and the risk of distractions. Third, we outline practical considerations for adopting metaverse platforms in organizational contexts, including customization, integration with workflows, and the importance of addressing privacy and usability concerns.

2 Background

This section provides the theoretical foundation for our study. We begin by discussing the challenges and particularities of communication and collaboration in remote software development teams. Next, we present key concepts used to evaluate user experience in metaverse environments. Finally, we review existing metaverse platforms and related studies, identifying gaps and contributions that inform our research.

2.1 Communication and collaboration in remote teams

Remote or distributed teams are composed of individuals who collaborate from different geographic locations. They rely on communication technologies to coordinate their activities (Bellotti and Bly, 1996; Bailey and Kurland, 2002). This working model has become more common in the global corporate landscape, especially in the software development sector (Park et al., 2023). Advances in information technology and the growing demand for flexibility in the workplace have driven this trend (Bailey and Kurland, 2002; Parker et al., 2022).

Software development transforms user needs into products, encompassing the creation, maintenance, and improvement of products (IEEE Computer Society, 1990). Andres (2002) describes this process as a collaborative activity, in which success depends on knowledge sharing, information exchange, and effective communication among team members. However, the dynamics of collaboration become more complex when teams work remotely, presenting additional challenges for communication and coordination, such as difficulties in maintaining task alignment (Park et al., 2023).

According to Olson and Olson (Olson and Olson, 2000), distance affects teams in several ways. Among these effects is the lack of spontaneous interactions, which hinders the development of interpersonal relationships and limits the transmission of nonverbal cues (Andres, 2002). This situation creates difficulties in building shared understanding, as well as challenges in task coordination and ambiguity resolution (Olson and Olson, 2000; Mortensen and Hinds, 2001). Such social and professional isolation may lead to feelings of invisibility, which can negatively impact motivation and the sense of belonging to the team, undermining group performance and cohesion (Ford et al., 2021; Bailey and Kurland, 2002).

Furthermore, the absence of spontaneous interactions limits the ability to resolve issues quickly (Andres, 2002; Olson and Olson, 2000). In a traditional office, a question can be immediately clarified by asking a colleague. In a remote environment, even simple matters may require scheduling meetings or exchanging multiple messages, which increases the time needed to solve problems and make decisions (Bailey and Kurland, 2002; Morrison-Smith and Ruiz, 2020).

Another challenge is the low mutual awareness among team members. This lack of perception, or *awareness*, makes it difficult to understand others' activities, task progress, and the general project context (Dourish and Bly, 1992; Dourish and Bellotti, 1992). It can result in duplicated efforts, lack of synchronization, and difficulty in solving complex problems (Dourish and Bellotti, 1992; Morrison-Smith and Ruiz, 2020). Moreover, unclear contextual information can lead to misunderstandings and conflicts. The lack of adequate contextual cues in distributed teams may increase distrust and lead to incorrect attributions about colleagues' actions (Mortensen and Hinds, 2001). Physical distance exacerbates these issues, making it harder to directly observe activities and reducing trust in team contributions (Morrison-Smith and Ruiz, 2020; Olson and Olson, 2000).

2.2 Metaverse and User Experience

Studies indicate that key concepts such as social interaction, ease of use, presence, flow, communication, and collaboration are essential for users' immersive experience. These factors are directly related to the usability of metaverse platforms, influencing user satisfaction and engagement (Lee and Gu, 2022; Pallavicini et al., 2019). Therefore, we adopt these concepts to analyze and interpret this study's results as they reflect how users experience and engage in these environments.

Presence refers to the feeling of being in a virtual environment as if the user were physically in it (Takatalo et al., 2010). We consider two main dimensions: social and spatial presence (International Society for Presence Research, 2023). Spatial presence provides a sense of tangibility and reality in the virtual environment (Lee and Gu, 2022), making experi-

ences more engaging and immersive (Hartmann et al., 2015). Social presence involves the sensation of being present and interacting with other users or virtual entities (Biocca, 1997). Through this dimension, it is possible to strengthen online connections (Lo et al., 2024).

In a collaborative activity such as software development, good communication is essential for sharing information among team members (Andres, 2002). Social interactions are fundamental for establishing trust and relationships (Morrison-Smith and Ruiz, 2020). Additionally, ease of use is crucial for allowing users to perform their activities efficiently and without obstacles (Lee and Gu, 2022). Since the concept of flow requires a more detailed explanation, we describe it in the following subsection.

2.2.1 The Flow State

The Flow state, or optimal experience, is a psychological condition of deep immersion and complete engagement in an activity (Csikszentmihalyi et al., 2014). It emerges when the challenges of a task are balanced with the individual's perceived skills, requiring focused effort and fostering a sense of absorption (Csikszentmihalyi, 1999; Ritonummi et al., 2023). Flow contributes to subjective well-being and is defined by the conditions that facilitate its occurrence and the internal characteristics that describe the experience (Nakamura and Csikszentmihalyi, 2002).

Three core conditions facilitate the emergence of flow (Nakamura and Csikszentmihalyi, 2002):

- Clear goals: the definition of specific objectives that guide the activity (Csikszentmihalyi et al., 2014), allowing the individual to know what to do at each moment (Csikszentmihalyi, 1999).
- Balance between challenges and skills: flow emerges when the challenges imposed by the task are in tune with the individual's perceived skills (Nakamura and Csikszentmihalyi, 2002). If the challenge is much greater than the skill, it generates anxiety; if it is much smaller, it generates boredom (Csikszentmihalyi, 1999).
- Immediate feedback: rapid feedback on task performance or progress, allowing continuous adjustments and reinforcing the perception of progress and control (Csikszentmihalyi et al., 2014; Csikszentmihalyi, 1999).

When these conditions are present, individuals may experience internal flow characteristics, which reflect their perception and involvement in the activity (Nakamura and Csikszentmihalyi, 2002). The six dimensions that characterize the state of flow are:

- Merging of action and awareness: the person becomes so involved in the task that the action becomes automatic, occurring effortlessly as if everything flows naturally (Csikszentmihalyi, 1999).
- Intense Concentration: there is total focus on what is being done (Nakamura and Csikszentmihalyi, 2002), with the elimination of external distractions and irrelevant thoughts (Csikszentmihalyi, 1999).
- Loss of self-consciousness: occurs when the person ceases to perceive themselves, ignoring thoughts, emotions, or bodily sensations irrelevant to the activity (Csikszentmihalyi, 1999).
- Sense of control: perception of mastery over the activity and absence of fear of failure (Nakamura and Csikszentmihalyi, 2002).
- Loss of sense of time: subjective time seems to pass differently. For some, it speeds up; for others, it slows down, depending on the type of activity (Csikszentmihalyi et al., 2014).
- Autotelic experience: occurs when the activity is performed for the pure pleasure of doing it, regardless of external rewards (Csikszentmihalyi, 1999).

The flow experience yields several positive outcomes, particularly relevant in software engineering (Ritonummi et al., 2023). It is associated with satisfaction, intrinsic motivation, and persistence in the face of complexity (Lucchesi, 2019). In the workplace, flow fosters concentration, a sense of accomplishment, and creative thinking, all essential for addressing complex challenges (Ritonummi et al., 2023).

2.3 Metaverse Platforms and *Gather.Town*

Several companies, such as *Gather.Town*, have been developing metaverse environments beyond the physical world. The platform *Gather.Town*, launched in May 2020, stands out as one of the emerging metaverses. It is usable in formal business contexts, informal meetings, education, and events, presenting a versatile application (Lee and Gu, 2022; Lee et al., 2023). Users can customize avatars and virtual spaces conceived as physical places. The proximity between avatars influences interactions, and the platform offers features such as file sharing, screen sharing, videos, live streams, and integrated games (Gather.town, 2023). Its interactive nature sets it apart from traditional video calls by promoting greater engagement among group members (Lee et al., 2023).

Other companies, such as *SK Telecom* [2], explore the potential of the metaverse for advanced digital services, having acquired *ifland* as their platform. *Ifland* aims to build a mixed reality ecosystem in South Korea (Telecom, 2024). *Spatial Systems* [3] offers a platform for creating and sharing immersive social gaming experiences, accessible across different devices and online environments (Spatial.io, 2024). Finally, *Roblox Corporation* [4] is known for its gaming and content creation platform. However, it has been expanding its focus to include social and collaborative experiences in its growing metaverse, providing users with a rich and diverse environment to interact, create, and explore (Corporation, 2024).

2.4 Related Work

In recent years, several studies have investigated the use of synchronous videoconferencing and/or metaverse platforms by work teams (Lee et al., 2023; Park et al., 2023; Al Harthy et al., 2023; Sriworapong et al., 2022). The use of these

[2] https://www.sktelecom.com
[3] https://www.spatial.io/
[4] https://corp.roblox.com/

platforms increased due to the COVID-19 pandemic. They are not limited to fully remote teams, also being adopted by hybrid teams to foster the perception of collaborative work among members. There is also a study evaluating the flow experience in software development activities (Ritonummi et al., 2023), highlighting the factors that facilitate flow during the development process.

Lee et al. (2023) studied the impact of videoconferencing platforms, such as *Zoom*, and metaverse platforms, such as *Gather.Town*, on undergraduate students' collaborative learning. *Gather.Town* was perceived as more suitable for teamwork due to the sense of presence, spatial mobility, social presence facilitated by avatars, and interface differences. On the other hand, Park et al. (2023) explored the challenges and opportunities of using metaverse tools in remote work. Although participants enjoyed the experience, they "expressed concerns about surveillance", highlighting the need for a private environment and in-person interactions to build bonds among members.

Sriworapong et al. (2022) compared the platforms *Spatial.io*, *Gather.Town*, and *Zoom* to understand differences in usability and user experience in learning. *Gather.Town* stood out in facilitating student interactions, thanks to collaborative tools such as shared whiteboards and integrated games. In another study, Palos-Sanchez et al. (2023) evaluated the impact of using the *Gather.Town* platform on the cohesion of hybrid and fully remote teams in technology companies. Although participants "preferred face-to-face communication", they identified features in *Gather.Town*, such as informal interactions and access to contextual information about colleagues, that could enhance team cohesion. Meanwhile, Ritonummi et al. (2023) conducted a study evaluating the flow experience in software development activities. This study highlighted that working without distractions and excessive interruptions, maintaining an optimal challenge–skill balance, and high intrinsic motivation are key facilitators of the flow state.

This report addresses how the use of *Gather.Town* impacts the experience of remote software development teams. Unlike Lee et al. (2023) and Sriworapong et al. (2022), the focus is on professionals in the software industry. In contrast to Park et al. (2023), Palos-Sanchez et al. (2023), and Ritonummi et al. (2023), this report observes aspects of collaboration, communication, presence, and flow in remote development teams that use *Gather.Town*.

3 Research Overview

The study was divided into two stages. The first stage focused on aspects such as ease of use, communication and collaboration, presence, and social interaction. The second stage consisted of interviews focusing on participants' perceptions of the flow state, as well as the challenges that may influence the adoption or abandonment of *Gather.Town*. These two stages provided complementary insights into the use of metaverse environments by remote software development teams.

As illustrated in Figure 1, both stages followed the same research planning process, as described below:

Literature review: was conducted to support the theoretical foundation of the study and to guide the definition of relevant aspects for investigation. Based on this foundation, we designed instruments aligned with the specific objectives of each stage.

Instrument design: For both stages, a characterization form was created for participants, along with a consent form to ensure ethical compliance. For the first stage, a survey and an interview script were created to assess user experience in metaverse environments. In the second stage, two interview scripts were prepared: one focusing on the flow state, and the other on factors related to the use and discontinuation of Gather.town. Additionally, a brief presentation explaining the flow concept was created to ensure a shared understanding before the interviews.

Expert validation: All instruments were reviewed by experts, and adjustments were made based on their feedback to improve clarity and alignment with the study objectives.

Participant selection: The target audience included software development professionals who had used or were currently using the *Gather.Town* platform in their remote work.

Study execution: After the previous steps, the instruments were applied to participants in each stage of the study.

Data analysis: The collected data were analyzed using qualitative and quantitative methods, according to the objectives of each stage.

This planning enabled the structured and coherent execution of both stages. The procedures of the first stage are detailed in Section 4, and the results are presented in Section 5. The second stage is described in Section 6, with its corresponding results reported in Section 7.

4 Conducting the First Stage of the Empirical Study

For the first stage of the study, we adopted an approach that combined surveys and interviews to analyze aspects related to ease of use, communication, collaboration, presence, and social interaction. This approach aimed to *Gather.Town* data on participants' opinions, experiences, and perceptions regarding these aspects in the context of using the *Gather.Town* platform. The main instruments are described below.

Consent Form: We used a Consent Form to ensure the integrity and ethics of the research conducted, aiming to obtain voluntary consent from the professionals. In this way, the study ensured that participants understood the research objectives, the procedures adopted, and the guarantee of response anonymity.

Characterization Form: We used it to understand each participant's profile. It included questions related to age and the role the participant performs as a professional.

Questionnaire: We used it to investigate the main aspects related to the use of the metaverse in remote work. It was created using the *Google Forms* platform[5]. A total of 8 questions were used, based on a literature review on the evaluation of user experience in metaverse environments and on the

[5]https://docs.google.com/forms/

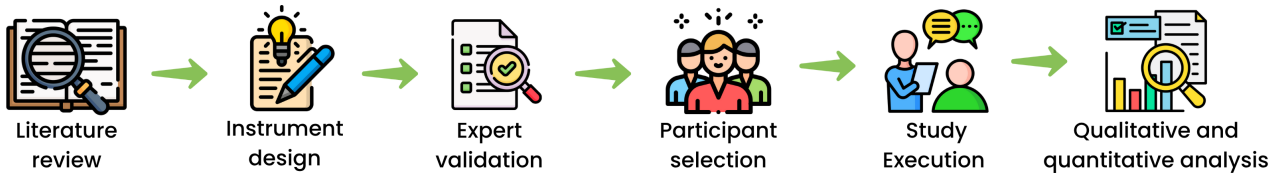

Figure 1. Overview of the research process followed in both stages of the study, including literature review, instrument design, expert validation, participant selection, study execution, and data analysis.

Slater-Usoh-Steed (SUS-II) questionnaire (Ribeiro and Monteiro, 2015). The main concepts addressed in the questionnaire included ease of use, social presence, spatial presence, communication, collaboration, and social interaction as applied to using metaverse platforms. Two experts in software engineering have validated the questions presented below:

1. To what extent do you believe that the ability to see your teammates in the same virtual environment contributes to the feeling of truly being present with them in the office?
2. To what extent do you believe that the ability to perform social actions in *Gather.Town*, such as greeting or showing approval with avatars, influences the motivation and sense of unity among team members during virtual meetings?
3. To what extent do you believe that the possibility of approaching a teammate in *Gather.Town* and starting a conversation, similar to in-person interaction, contributes to creating a sense of closeness within the team?
4. How often do you engage in informal discussions or social interactions with your teammates in more relaxed areas of *Gather.Town*, such as break zones?
5. How engaged do you feel during meetings in *Gather.Town* compared to other videoconferencing platforms?
6. During the experience in *Gather.Town*, when moving with your avatar, did it resemble the feeling of walking through a physical office?
7. When recalling the scenario presented in *Gather.Town*, do you see it as an image or as an office where you were actually present?
8. During your experience in *Gather.Town*, was the sense of being in another place stronger, or was the sense of being in the virtual office stronger?

To answer the questions, participants used a 5-point Likert scale (Likert, 1932) to indicate their level of agreement. Some variations included: ´´Did not remind me at all" to "Reminded me completely" to measure the perception of moving with avatars in *Gather.town*; "Did not contribute at all" to "Contributed completely" to assess the impact of virtual social interactions; and "Does not influence at all" to "Influences completely" to analyze how social actions in *Gather.town* influence team motivation and unity. We also used a scale from 1 to 5 to measure the intensity of the feeling of being in the virtual office versus being somewhere else during the experience in *Gather.town*.

Interview Script: It enabled a deeper understanding of practitioners' perceptions regarding using *Gather.town* in the work environment. The script followed a structured format and consisted of open-ended questions. This approach allowed participants to express their opinions in more detail. We present the questions developed in the script below:

- Was the transition from a conventional platform to a metaverse environment easy?
- Does the ability to approach colleagues and explore spaces in *Gather.Town* make you feel more present in the virtual office environment compared to other online meeting tools? Or does it make no difference?
- In your opinion, does workflow more efficiently in *Gather.Town* compared to other platforms? If so, how?
- In your opinion, does *Gather.Town* make it easier for people to offer help and collaborate voluntarily compared to other meeting tools? If so, in what way?
- Do you engage in any activity in *Gather.Town* purely for the pleasure of the activity itself, without expecting rewards or benefits? For example, non-work-related activities in the tool?
- Is there any point you would like to comment on?

After defining the instruments, the experience involved five stages. We describe the procedures adopted in each stage in the paragraphs below:

Stage 01 – Participant Recruitment: We contacted different practitioners via *email*, where we explained our research's purpose. In summary, 10 practitioners expressed interest in joining the study.

Stage 02 – Completion of the Informed Consent Form and Characterization Form: After various practitioners volunteered to participate in our study, they filled out both the Consent and Characterization Forms. Each participant filled these documents asynchronously and at different times, ensuring flexibility and accommodating their schedules.

Stage 03 – Completion of the questionnaire: Each participant proceeded to fill the questionnaire. This approach ensured that all participants could contribute conveniently, without time pressure, which was essential for obtaining reliable responses.

Stage 04 – Conducting interviews: After completing the questionnaire, each participant was invited to take part in an interview. Each interview lasted approximately 10 to 15 minutes, and their participation was voluntary. During the interview, participants were able to provide a more detailed understanding of their experience using *Gather.town* during remote work. We scheduled the interviews based on participants' availability. All 10 participants completed the questionnaire, and 6 of them also volunteered for the interview. To ensure comprehensive data collection, the full set of questionnaire questions was administered to all participants, while the complete interview protocol was applied to the 6 interviewees.

Stage 05 – Data analysis: After stages 04 and 05, all responses were included in the analysis. We examined the questionnaire data using graphs to represent the level of agreement with each statement, which helped identify patterns and trends in participants' perceptions. We conducted the questionnaire response analysis through graphs presenting the agreement level for each statement. It allowed identifying patterns and trends in participants' perceptions.

The interview responses were fully transcribed and analyzed using procedures from Straussian Grounded Theory (GT) (Strauss and Corbin, 1990). We applied open coding, in which the data are broken down into smaller parts and descriptive codes are developed to capture the essence of each segment, enabling the understanding and categorization of the studied phenomena (Vollstedt and Rezat, 2019).

Open coding was carried out in two cycles. In the first, a researcher identified emerging codes; in the second, the codes were reviewed by two experts. Code creation followed the constant comparison method, allowing us to identify recurring patterns and themes in participants' narratives. After discussions and adjustments among the researchers, the codes were organized into categories that supported the interpretation of the analyzed concepts.

The same experts validated the categories, and we adjusted them based on the feedback provided. We created these categories for evaluating the user experience in the metaverse based on the key concepts indicated in Section 2, including aspects such as social interaction, communication, collaboration, presence, and ease of use. We identified and grouped the emerging codes that were related to these categories.

Finally, we performed data triangulation using the information from the questionnaire and the interviews. This approach made it possible to obtain insights and draw conclusions about the impact of using metaverse tools on the user experience in remote software development teams.

5 Results of the First Stage of the Study

This section presents the study's results on how metaverse environments impact the experience of members of remote software development teams. The analysis considers aspects such as ease of use, communication and collaboration, presence, and social interaction. Table 1 summarizes the participant profiles: developers (50%), software analysts (30%), and designers (20%). The participants reported an average age of approximately 26 years.

Most participants were affiliated with company E1, while the remaining individuals were distributed among companies E2, E3, E4, and E5. The characterization of these organizations is presented in Table 2. Each participant belonged to a team composed of 8 to 12 members. These teams operated independently, without interaction between them; however, participants maintained regular communication with their own team members, including those who did not take part in the study. This structure ensured that the experiences reported were based solely on the internal dynamics of each team, free from external influence. Furthermore, all participants stated that they used Gather during regular working hours, five days a week.

The following subsections discuss the results from the analysis of the questionnaires and interviews. The questionnaire results focus on aspects of presence and social interaction (Section 5.1). The interview analysis followed the categories identified in the literature: ease of use, communication and collaboration, presence, and social interaction (Section 5.2).

5.1 Questionnaire results

Gather.town stands out as a virtual environment that promotes a sense of presence and provides a realistic user experience for participants. Figure 2 illustrates that the ability to see colleagues in the same virtual environment significantly enhances the sense of team presence, as reported by 90% of the participants. This feature is crucial in maintaining connection and engagement among team members.

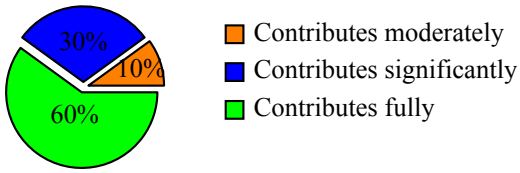

Figure 2. The contribution of viewing colleagues in the virtual environment to participants' sense of presence.

In addition, participants emphasized that moving with the avatar resembles walking through a physical environment (Figure 3). Specifically, 80% of the participants stated that this feature strongly or fully resembles the experience of moving around a traditional office. This highlights that *Gather.town* not only offers a more immersive experience but also reinforces the feeling of being physically present with colleagues.

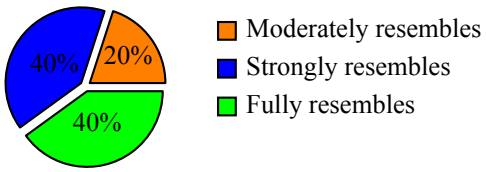

Figure 3. Experiencing a sense of movement in a physical office while moving the avatar in *Gather.town*

According to Figure 4, *Gather.town* facilitates social interactions by allowing users to approach a colleague and start conversations in a way that mirrors in-person interaction. 90% of the participants indicated that this ability to approach a teammate and initiate a conversation contributes significantly or fully to creating a sense of closeness and cohesion within the team. This shows that *Gather.town* promotes frequent social interactions and reinforces the feeling of physical presence with colleagues. Furthermore, *Gather.town* fosters an environment where informal discussions and social interactions become viable, bringing team members closer together.

As Figure 5 illustrates, the results show that 50% of the participants frequently engage in informal discussions or social interactions in more relaxed areas of *Gather.town*, such

Table 1. Participant characterization: includes information on participants' age, occupation, company, team affiliation, and whether they took part in the first, second, or both stages of the study.

Participant	Age	Occupation	Company	Team	Study Participation
P01	23	Software Analyst	E1	T1	Both
P02	37	Developer	E2	T2	Both
P03	22	Developer	E3	T3	First
P04	21	Developer	E1	T4	Both
P05	23	Developer	E1	T5	Both
P06	38	Software Analyst	E1	T5	Both
P07	21	Designer	E1	T5	Both
P08	23	Developer	E1	T5	First
P09	24	Designer	E1	T5	Both
P10	35	Software Analyst	E1	T5	First
P11	26	Developer	E4	T5	Second
P12	27	Software Analyst	E1	T6	Second
P13	25	Developer	E5	T7	Second

Table 2. Company characterization: includes the year of operation, number of employees, and type of service provided by the companies where participants work.

Company	Years of Operation	Employees	Main Service
E1	23	1,000–5,000	Software services for external clients
E2	4	200–500	Internal software development
E3	4	11–50	Software solutions for external clients
E4	14	200–500	Technology solutions in the financial sector
E5	7	11–50	Software development for external clients

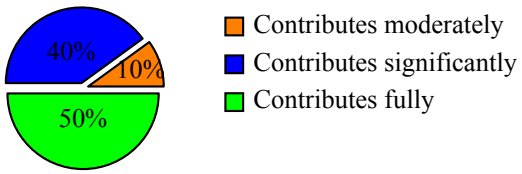

Figure 4. *Gather.town* contributes to fostering team closeness.

as break zones. In addition, 20% of the participants reported engaging heavily in these interactions, while another 20% stated they engage moderately. Only 10% of the participants indicated low engagement. This dynamic contributes to a lighter and more collaborative environment, promoting a sense of unity and engagement within the team.

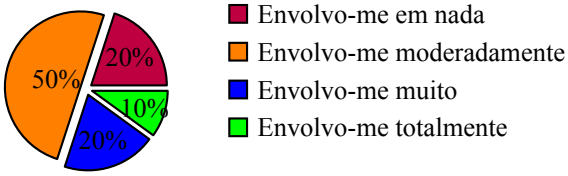

Figure 5. The frequency of informal discussions and social interactions in the lounge areas of *Gather.town*.

5.2 Interview results

Table 3 summarizes qualitative results from interviews on the use of *Gather.Town* in remote software teams. The table consolidates the results discussed in this section, highlighting the most relevant aspects identified. The columns present each aspect, a description, and its practical implications. These implications help to understand the impact of each aspect on team dynamics and collaboration, illustrating how *Gather.Town* can influence remote work environments.

The main findings from the qualitative analysis on the use of *Gather.Town* in remote software teams are summarized in Table 3. It highlights the most relevant characteristics we identified. The columns present the analyzed feature, a detailed description, and the observed practical implication. Each feature includes its implications to facilitate understanding the impact on work and collaboration dynamics, emphasizing how *Gather.Town* can influence the remote work environment.

Ease of Use: Participants' perceptions regarding the ease of use of *Gather.Town* in remote software teams revealed differences between developers and analysts. Developers described a smooth and intuitive initial experience, while analysts reported initial difficulties. P01, an analyst, stated: *"In the beginning, I had a bit of difficulty handling the movements, where each place was, what each thing did..."*. On the other hand, P02, a developer, reported: *"I did not have much difficulty, because it is interactive..."*.

In addition, some participants viewed prior gaming experience as a facilitator, such as P05: *"...I believe it was easier for me... I do not know if my experience with games influenced that..."*, and P06: *"...I noticed that others since they already have more of that habit related to games, (...) for them it was smoother..."*. However, P03 expressed a different view: *"You do not necessarily need to have gaming experience to have better integration with Gather"*, although they did point out the use of keys commonly found in games: *"You literally just need to use the arrows or a, w, s, d to move around in Gather"*. The time invested in using the tool and the support from colleagues also played a role. As P01 men-

tioned: *"...later on, other people who already had experience were able to guide me, and then it got much easier, after some time using it..."*, and P02 added: *"...with a short amount of use, you already understand all its functionalities"*.

Participants highlighted positive aspects of *Gather.Town*, such as interactivity, as noted by P02: *"...it (Gather.Town) is very interactive (...) it has a really nice visual (...), very dynamic (...), several themes..."*. P05 mentioned the familiarity with the icons: *"with the icons we are already used to, for example the camera icon, which exists in Google (Meet)*[6]*, (...) the little microphone and all, so you can already understand what was going on"*. P04 emphasized the intuitiveness of the platform: *"(...) it is very intuitive, you get there and start using it, start walking, start (...) discovering while you are doing it"*. P04 also mentioned the convenience of screen sharing: *"you can quickly share the screen, (...) no need to open a thousand other tabs, you do everything in one place"*.

Although *Gather.Town* offers advantages in interactivity and ease of use, some negative aspects may limit its effectiveness. The maximum capacity of ten people per space presents a limitation, as noted by P04: *"The only thing I think is bad, but (...) it is because you have to pay, starting from ten people, if I am not mistaken"*, and by P03: *"when we want to schedule a meeting with more people and we cannot, (...) because of this limitation"*. The free version supports up to ten users, and larger groups require a paid enterprise plan.

Another issue involves the difficulty of wearing headphones throughout the entire use of *Gather.Town*. This concern was explained by P06: *"for me it was hard to stay, for example, 100% of the time with headphones. (...) sometimes I was working on a screen, and I needed to stay online in Gather in case someone called me"*. P06 also raised concerns about usability concerning age: *"But for older people, usability is not as simple as it is for the generation that is already digitally native"*.

Communication and Collaboration: Interaction in *Gather.Town* resembles in-person dynamics. P02 pointed out: *"I want to talk to someone. I go to their little desk (...) and I'm already talking to them directly, (...) same as if I were working in the office"*. P03 added: *"So it becomes much easier, because you already have to be in the room, you are already there, people just come up to you and call: Hey, meeting now. Done"*. This shows that *Gather.Town*, as participants affirmed in Figure 3, reflects the dynamics of movement and interaction in a physical office when starting a conversation.

Interaction in *Gather.Town* simplifies communication, especially when scheduling meetings, by eliminating the need to generate *links*. P05 stated: *"For me, it was much simpler, especially because there was no need to generate a link. It was really something everyday. I entered a room and I was already talking to someone"*. P01 agreed: *"It is much easier for me to go to someone's little table who is online and call them faster than sending them a call and waiting for them to respond"*. P03 highlighted the efficiency: *"For me, it is much easier than sending a link, then some people cannot connect, and there is that delay. So for me, communication becomes much better"*.

[6]https://meet.google.com/

The ability to quickly start conversations and resolve doubts represents an important advantage. P05 commented: *"It (Gather.Town) speeds up the process a lot for me to communicate with someone, for the person to ask questions, for the person to see what I am doing, it is a very fast connection, so it flows very well"*. P03 agreed: *"In this matter of being able to (...) solve problems and help others, it is much easier than doing it (...) in any other platform"*.

However, staying constantly *online* can pose challenges. P06 explained: *"For me, (...) since I have this difficulty of staying online all the time (...) like listening to the conversation, I felt the need to stay a bit offline to focus on activities that demanded more concentration and focus"*. This account emphasizes the importance of balancing *online* collaboration with *offline* moments to maintain focus on tasks that require deeper concentration.

Presence: The ability to greet colleagues with a simple wave makes the experience in *Gather.Town* feel closer to in-person interaction, creating a welcoming environment for social connection. P05 commented: *"(...) you enter the Gather environment, then you can click on your colleague's little avatar who is in their room and wave, which would be like: hi, I am here"*.

Seeing colleagues and perceiving their active presence in the virtual office helps team members avoid feeling isolated. P03 observed: *"(...) it gives that kind of feeling like: oh, everyone is here, or everyone came here"*, and P01 added: *"Each one at their desk, meeting desk, some rooms, so that created in a way a closeness with colleagues who are not physically present"*. This sense of presence helps users feel comfortable with team members (Figure 2) and brings satisfaction, as pointed out by P03: *"At least you are seeing the other person, it is much better for me. I feel more comfortable this way, it gives pleasure, right, pleasure to be there on the platform"*.

The transparency provided by the visibility of colleagues' activities represents another important aspect of *Gather.Town*. This not only builds trust in team members' contributions but also provides clarity regarding each person's availability and engagement in activities. P02 highlighted: *"you know that the person is in the work environment doing their job there, because when someone leaves for example to go to the bathroom, or to get some water, they put there a little 'status' (...) then you know that person is away for some reason"*.

These accounts show that the environment simulated by *Gather.Town* resembles the real work environment of development teams, creating a virtual atmosphere that mirrors the dynamics of in-person interactions. P01 expressed: *"It is a tighter environment that reflects a bit (...) of our reality, right? Each one at their desk, meeting desk, some rooms"* and P02 added: *"It is as if you were in the office, but in a completely virtual office"*.

Social Interactions: The presence of informal spaces, such as break rooms, plays a fundamental role in strengthening interpersonal bonds and fostering team member integration. As illustrated in Figure 5, 90% of the participants engage in discussions and interactions in these environments. According to P05, these moments make interaction, rapport, and collaboration easier among colleagues, as shown in the comment: *"there comes a moment when everyone is gath-*

Table 3. Perceptions of the Use of *Gather.Town* in Remote Software Teams Regarding Ease of Use, Communication, Collaboration, Presence, and Social Interaction

Aspect	Description	Implication
Gaming Experience	Users with prior gaming experience	Facilitates adaptation to the platform
Initial ease of use	Difference in initial ease of use between developers and analysts	Developers adapt more easily than analysts
Interactivity	Positive aspects of *Gather.Town* in terms of interactivity and visuals	Contributes to a more pleasant and intuitive user experience
User limitation	Limit of ten users per environment in the free version	May reduce effectiveness in larger meetings
Constant headphone use	Difficulty in continuously wearing headphones during use	May become uncomfortable during extended activities
Balance between *online* and *offline*	Difficulty staying online constantly due to the need to focus on other activities	Highlights the importance of balancing online collaboration with offline moments to maintain task focus
Comparison with in-person dynamics	Comparison between interaction in *Gather.Town* and in-person dynamics	Brings online interaction closer to in-person experiences
Meeting scheduling	Simplicity in scheduling meetings without the need for links	Facilitates communication and collaboration
Quick resolution of questions	Ease in starting conversations and quickly resolving questions	Speeds up communication processes and problem-solving
Presence and visibility of colleagues	Feeling of active presence of colleagues in the virtual office	Enhances the sense of proximity and collaboration
Informal spaces and games	Presence of break rooms and games to strengthen bonds	Promotes integration and relaxation among team members

ered, really in a meeting room, so there is a conversation here, a conversation there, a meeting here, a little joke, then back to work, so my rapport with the team improves a lot and my collaboration with them".

Even in teams composed of members with different roles and responsibilities, the existence of shared virtual spaces promotes closeness and frequent contact, as noted by P06: "*I noticed that even if we were not involved in the same activities, in this case, right, for example, the QAs and Devs, yes, the fact that we were there in the virtual environment and had those meeting rooms or relaxation rooms, it did bring us closer and made contact more frequent"*.

In addition, using games as a strategy to relax and strengthen team spirit proved effective, as highlighted by P01 and P02, who mentioned: *"we used to take a little time to play those games, explore the tool a bit"* (P01) and *"There are some with a racetrack, when we were there, at a time when no one could, when everyone was stuck, we would go there, play a little, and then go back, so it is an environment that relaxes the whole team, it does not stay that tense"* (P02).

6 Conducting the Second Stage of the Empirical Study

We conducted a second instance of the empirical study. Limitations identified in the first stage, particularly those related to maintaining concentration, motivated us to investigate participants' perceptions of the flow state in metaverse environments. Reports of organizational restrictions and usability issues also raised the need to explore factors that influence the adoption or abandonment of platforms such as *Gather.town*. Based on these findings, we proposed recommendations to support the use of metaverse environments by remotes development teams. To guide the investigation of the flow state, we formulated hypotheses for a comparative analysis of participants' perceptions regarding the frequency of experiencing flow when using or not using metaverse tools such as *Gather.town*, as follows:

- **Null Hypothesis (H_0):** There is no difference in the frequency with which participants enter the flow state when working with *Gather.Town* and without it.
- **Alternative Hypothesis (H_1):** There is a difference in the frequency with which participants enter the flow state when working with *Gather.Town* and without it.

Regarding the instruments adopted, we used the same Consent Form and Characterization Form applied in the first instance of the experience. In addition, we also used:

Flow Presentation: A document briefly introduces the concept of the flow state and its related characteristics.

Interview script on the flow state: This script was designed to investigate professionals' experience related to the flow state during work, especially when using environments such as *Gather.town*. The questions aim to understand how frequently participants enter this state, which factors influence it, and what perceived differences exist between using *Gather.town* and traditional remote work. We describe the questions below:

- How often do you enter the flow state during work? Can you describe a recent example?

- When working in *Gather.town*, do you notice any difference in how easily you enter the flow state?
- On a scale from 0 to 5, where 0 means "never" and 5 means "always," how often do you feel you enter the flow state while working in traditional remote settings (without *Gather.town*)?
- On a scale from 0 to 5, where 0 means "never" and 5 means "always," how often do you feel you enter the flow state while working in Gather?
- In your opinion, does *Gather.town* help you understand your goals and receive feedback on your work? If so, in what way?
- While using *Gather.town*, were you able to fully concentrate on your tasks? What helped or hindered your concentration?
- Did you perceive the workday differently when using *Gather.town*? Can you compare it with a workday in a traditional remote setting without *Gather.town*?

Interview script on the use of *Gather.town* in software teams: This script was developed to understand professionals' experiences and perceptions regarding the adoption, use, and challenges that may lead to the abandonment of *Gather.town* in the context of software development teams. The questions aim to explore the factors that influenced the use of the tool and its limitations, as well as to identify possible improvements and recommendations for future use. The questions included in the script are:

- Did you face any difficulties while using *Gather.town*? If so, what were they?
- Did the decision to stop using *Gather.town* come from the team or the company? Why?
- How often did you actively use *Gather.town* during work? What influenced this frequency?
- Did your team experience any technical issues or limitations while using *Gather.town*? If so, what were they?
- Was there any functionality missing in *Gather.town* that had to be replaced by other tools? If so, which tools were used?
- Did these difficulties or limitations influence the decision to continue or stop using *Gather.town*? If so, how?
- After *Gather.town*, which tools did your team start using?
- What advantages and disadvantages do you notice between *Gather.town* and the new tool?
- What could be improved in *Gather.town* to make it more useful for software development teams?
- What would make you want to use *Gather.town* (or another metaverse environment) again at work? Which aspects of this type of environment are most appealing to you?
- What recommendations would you give to professionals or software development teams that are starting to use or planning to adopt *Gather.town*?

After defining the instruments, we began the participant recruitment and data collection process, described in the following five steps:

Step 01 – Participant Recruitment: We first contacted participants from the initial experience execution and invited new professionals. Out of the 10 participants from the first round, 7 agreed to participate in this new interview round. In addition, we included three new practitioners, whose we summarize their profiles in Table 1.

Step 02 – Completion of the Consent Form and Characterization Form: After agreeing to participate in the empirical study, the invited professionals were instructed to complete, asynchronously, the Consent Form (CF) and the Characterization Form. The documents used were the same as those applied in the first cycle of the experience, which ensured methodological continuity across the research cycles.

Step 03 – Introduction to the concept of Flow: Before starting the interviews, we presented a brief overview of the concept of flow, aiming to align participants' understanding of the construct under investigation. This introduction also addressed the dimensions of the flow state, such as clear goals, intense concentration, loss of sense of time, and sense of control, as discussed in Section 2.2.1. By ensuring this conceptual alignment, we sought to guarantee that participants' responses were based on a shared and appropriate understanding of the research theme.

Step 04 – Conducting the interviews: After introducing the concept of flow, participants were invited to participate in semi-structured interviews conducted remotely. We scheduled the interviews according to each participant's availability and conducted them individually. During this step, we conducted both interview scripts sequentially, and each interview lasted between 15 and 20 minutes on average. With participants' consent, we recorded the interviews using audio tools to enable subsequent analysis.

Step 05 – Audio transcription and analysis of results: The audio recordings of the interviews were transcribed to initiate the data analysis.

To qualitatively analyze the results from the flow interview script, we adopted the dimensions of flow as predefined themes, which allowed us to identify excerpts related to immediate feedback, loss of time awareness, and intense concentration. As the analysis progressed, new themes emerged inductively and were incorporated into the coding framework. This iterative process enabled the construction of relationships between themes, illustrating how the flow dimensions connected with other emerging topics. The themes were later discussed and refined in collaboration with another researcher, aligning them with flow theory and the study's aims to better represent participants' experiences. Therefore, for this part of the analysis, we employed Reflexive Thematic Analysis (RTA), as proposed by Braun and Clarke (2021). This approach was chosen because it enables the development of themes and supports the use of predefined ones that guided the coding process.

For the interview script related to the experience of using *Gather.Town*, a similar procedure was followed. The transcripts were reviewed to identify relevant excerpts, which were then coded and grouped based on recurring meanings. Through this iterative process, themes were developed that reflect participants' perceptions of *Gather.Town*, aiming to identify the factors that influence both the abandonment and adoption of the platform.

In addition, we performed a quantitative analysis related to the frequency with which participants reported entering the

flow state while using *Gather.town*, or not. We first applied the Shapiro-Wilk normality test on the difference between reported scores to assess data distribution. The test returned a *p-value* of 0.276, indicating that the data followed a normal distribution. Based on this, we selected the paired Student's t-test, a parametric test suitable for dependent and normally distributed samples. We also used measures of central tendency and boxplot charts to understand the data distribution.

7 Results of the Second Stage of the Study

In this section, we summarize the findings from the second stage of the empirical study. We divided our analysis into three main topics: participants' perceptions regarding the flow state, motivations for discontinuing the use of *Gather.town*, and recommendations for its adoption in the daily activities of remote software development teams.

Compared to the first stage of the empirical study, three new participants were included in the second stage, as shown in Table 1. Participants P11, P12, and P13 had not taken part in the initial stage. The table also indicates which participants from the first stage participated in this second one. The teams to which the new participants belonged were composed of approximately 6 to 10 members.

It is important to note that participants from the first stage were no longer using *Gather.town* at the time of the second data collection, which allowed them to reflect on their motivations for discontinuing its use. Only one participant (P02) did not report a specific reason for abandoning the platform, as the discontinuation was due to their departure from the company rather than a decision about the tool itself. As a result, this participant answered only the questions related to the flow state.

7.1 Perception of flow state

Based on the qualitative analysis of the data collected through the flow-state interviews, we constructed three relationship networks showing the relationship between the codes, as illustrated in Figures 6, 7, and 8. Each network illustrates the participants' perceptions regarding the use of *Gather.town* in relation to different dimensions of the flow state: immediate feedback, loss of sense of time, and intense concentration. As a supplementary step, a quantitative analysis was conducted to support and extend the qualitative findings by comparing how frequently participants reported experiencing flow states with and without the use of *Gather.town*. The following sections detail how participants' experiences manifested across the different identified dimensions, highlighting environmental elements that either supported or, in some cases, hindered the experience of flow within this virtual work context.

7.1.1 Qualitative Analysis Results

Immediate feedback: This is considered one of the conditions for the emergence of the flow state. It allows individuals to receive information about their performance quickly, adjusting their actions continuously and fluidly (Nakamura and Csikszentmihalyi, 2002). As illustrated in Figure 6, in the context of *Gather.town*, this dimension is mainly associated with interactions aimed at resolving questions, perceived as part of the real-time information exchange process. P02 illustrated this experience by stating: *"I shared my screen with him, opened it, showed it, and: 'Oh, it is this here!'. In that kind of feedback, inside there, I had a way to trigger flow more easily."*

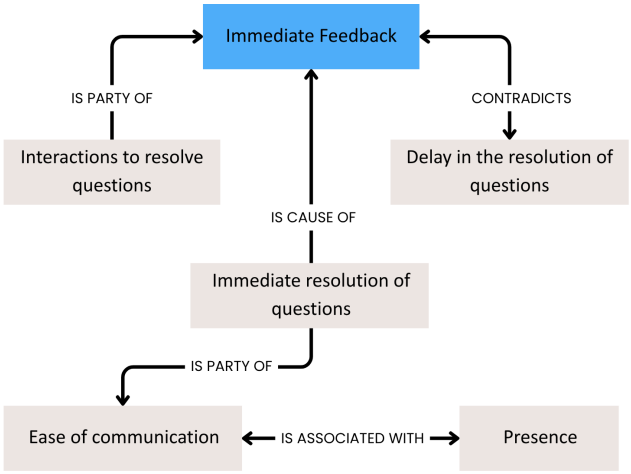

Figure 6. Perception of immediate feedback network: the blue rectangle indicates the flow dimension, and the light pink nodes represent related codes

Similarly, P04 and P09 emphasized how quickly solving doubts directly impacted their task continuity. P04 stated: *"I asked for a call with someone, got the answer, and continued what I was doing. So it helped me in that sense, being able to talk quickly with people."* P09 added: *"They were quick calls and, right there, I showed what I was doing and got feedback — not personal or professional feedback, but feedback on what I was doing."*

This quick resolution of questions was identified as one of the causes of immediate feedback, related to the ease of communication offered by the environment. As P02 highlighted: *"In case of any difficulty, obstacle, or question, it was easier to drop by the bay with a colleague, the PO or Product Manager, or even another dev colleague, to get some feedback or understand what was going on in a given task."*

As discussed in the section on communication and collaboration (Section 5.2), the ease of communication perceived in *Gather.town* is directly related to the sense of presence. This feeling arises from the simulation of an environment similar to the physical office. The replicated dynamics in the virtual space enable more spontaneous and natural interactions, which contribute to fast and effective exchanges.

On the other hand, participants reported the absence of such agility in more traditional remote environments as an obstacle. According to P04: *"When we have a doubt, it is annoying to have to send a call and wait for the person to join. It ends up breaking your train of thought*." This kind of interruption negatively impacts work rhythm and disrupts task focus, as individuals stop receiving immediate feedback on their activities, breaking the continuous flow of action and response required to sustain the flow state.

Loss of sense of time: This is an internal flow characteristic. It occurs when individuals become so engaged in the

activity that they stop noticing the passage of time (Csikszentmihalyi, 1999). While using *Gather.Town*, participants reported experiencing this dimension during periods of deeper focus and work continuity (Figure 7). P05 described this sensation by stating: *"Time went by faster, especially when we got to the daily... The daily was at eleven o'clock, we blinked and suddenly it was already noon."* This statement illustrates how the experience within the environment contributed to a subjectively accelerated perception of time, which is typical of the flow state.

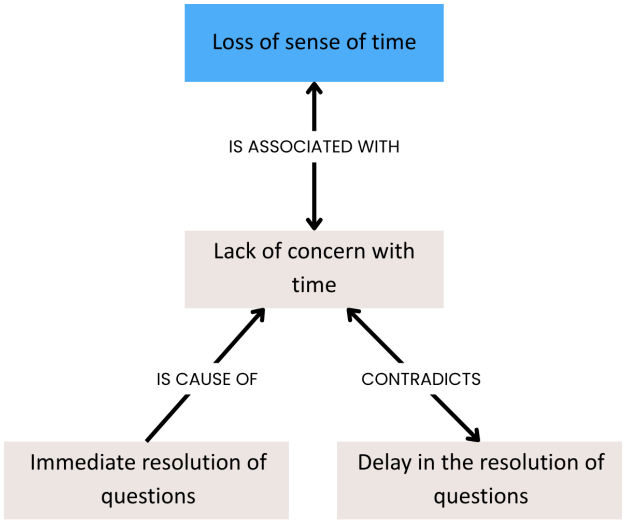

Figure 7. Perception of the loss of sense of time network: the blue rectangle indicates the flow dimension, and the light pink nodes represent related codes

This dimension is also linked to lack of concern with time. Immediate resolution of questions contributed to this feeling, eliminating anxiety about deadlines. As reported by P12: *"With Gather, I did not see it, I did not worry like: 'I have to deliver something, but I have a question.' And the person would respond right away, so I did not worry about time."*

However, the same participant reported that this lack of concern disappeared when using asynchronous tools. P12 added: *"When I asked questions through Chat or Teams, there was always a delay in the response. So sometimes I would keep checking, like: 'Wow, they still haven't replied'. I kept looking at the time a lot, because I had a question and it was only answered three or four hours later."* Delays in resolving questions caused attention to shift, disrupting task continuity and making it harder to achieve a flow state.

Intense Concentration: This is one of the internal characteristics of the flow state. It refers to maintaining continuous focus on the task. In the context of *Gather.town*, participants ambiguously perceived this dimension. In some moments, the environment supported concentration, while in others, it disrupted it, depending on the dynamics and interactions involved (Figure 8).

During work-related situations, especially technical exchanges, participants reported maintaining concentration. As P01 stated: *"In moments when we were there talking about some work topic or clearing doubts, something like that, yes, I managed to focus on my task and solve doubts."* However, interactions were also perceived as potential sources of interruption. P02 explained: *"Sometimes, it is about priorities. Even knowing that you are busy, they still come. So sometimes you are doing something, and then a higher priority issue comes up, and you have to stop what you were doing. That ends up... getting in the way."*

On the other hand, different elements of the virtual environment disrupted concentration, contradicting this flow dimension. One factor mentioned was access to games in the platform. P13 noted: *"Depending on how distractible your team is, Gather can become distracting because of the number of things to do in it, the games."* P09 added: *"It distracts. Sometimes I would be building something or playing kart."* Another factor was the customization of the environment, which also contributed to the loss of focus. P04 stated: *"I kept wanting to customize my avatar, decorating my room."* That same behavior was reinforced by P09 in their previous quote about distractions with building activities.

In addition, situations involving interruption-related tension — when the expectation or occurrence of an unexpected call causes discomfort or constant alertness — also affected concentration. P06 explained: *"If I had any task that required concentration, I preferred to leave Gather, because it felt like I was not alone there and that I had to stay alert, in case someone called me at any moment."* P11 also highlighted this impact: *"It startled me when I heard someone calling me, because, suddenly, I heard a sound and, when I was focused, it usually startled me."*

7.1.2 Quantitative Analysis Results

To examine whether there was a difference in how often participants reported entering the flow state when using *Gather.town* compared to when they did not, we collected participants' self-assessments during the flow-focused interviews. Each participant rated both conditions by assigning a real-valued score from 0 to 5, where 0 means "never" and 5 means "always", indicating how frequently they experienced the flow state. The results of these responses are presented in Table 4.

Table 5 presents the mean and standard deviation of the scores assigned by participants for the frequency of entering the flow state under both conditions. On average, participants reported experiencing the flow state slightly more often without the use of *Gather.town* (M = 3.7, SD = 1.25) compared to when using the platform (M = 3.2, SD = 1.32).

Figure 9 illustrates the distribution of responses through a boxplot comparing both conditions. The plot shows that the median score without *Gather.town* is higher (approximately 4) than the median with *Gather.town* (approximately 3), suggesting a tendency for participants to report more frequent experiences of flow when not using the platform. Additionally, the data dispersion is similar in both conditions, and no extreme outliers were observed.

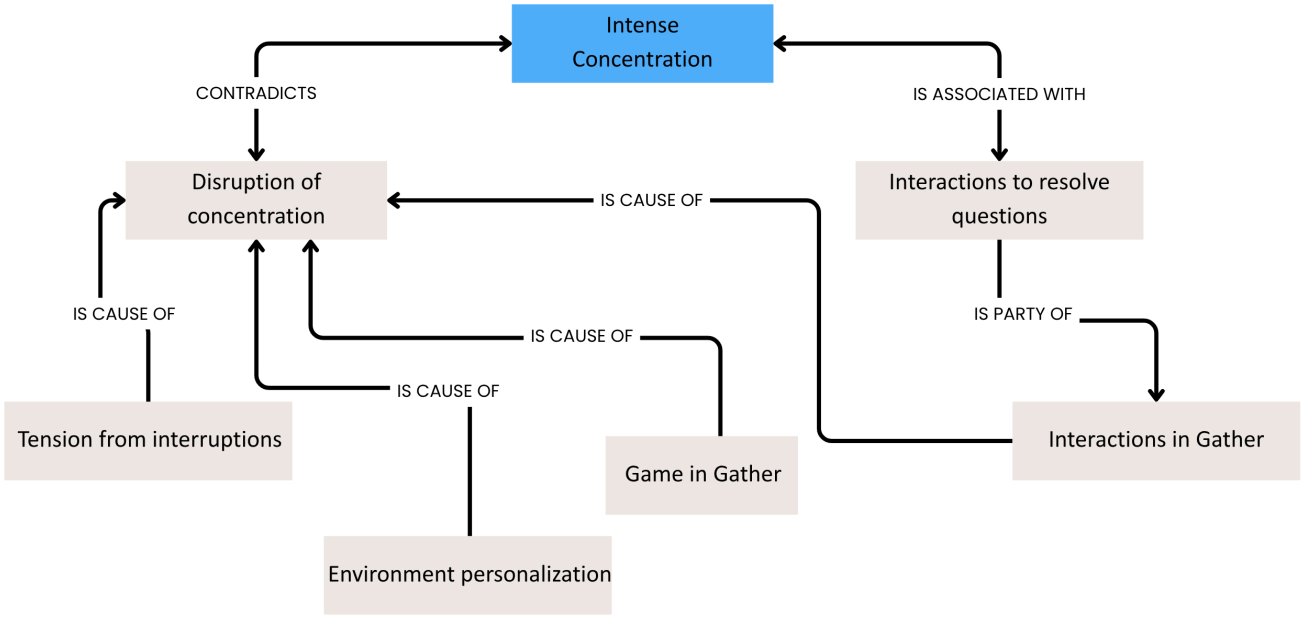

Figure 8. Perception of intense concentration network: the blue rectangle indicates the flow dimension, and the light pink nodes represent related codes

Table 4. Scores assigned by participants for flow frequency

Participant	Without *Gather.Town*	With *Gather.Town*
P01	5	5
P02	3	2
P04	5	5
P05	3	4
P06	3	4
P07	1	2
P09	4	3
P11	4	1
P12	5	3
P13	4	3

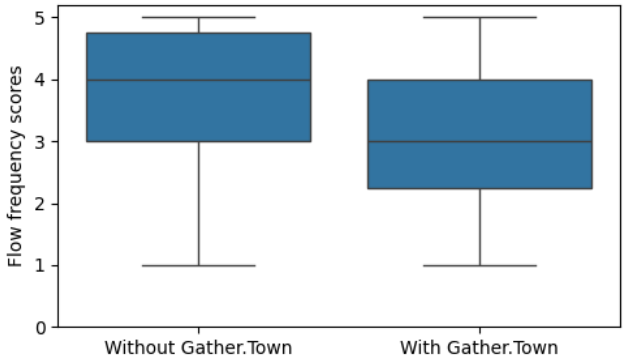

Figure 9. Boxplot illustrating the distribution of flow frequency scores under conditions with and without the use of *Gather.town*

Table 5. Mean and standard deviation of flow frequency scores

Condition	Mean	Standard Deviation
Without *Gather.town*	3,7	1,25
With *Gather.town*	3,2	1,32

We also compared the frequency of entering the flow state between the conditions with and without the use of *Gather.town* through a statistical analysis. This step was conducted using the Jasper tool, version 0.17.3, considering a significance level of $\alpha = 0.05$. This value was defined due to the sample size limitation (Dyba et al., 2006).

Before the comparison, we applied the Shapiro-Wilk test to assess the normality of the data, considering the differences between the scores assigned under both conditions. The result showed a p-value of 0.276, suggesting that the data follow a normal distribution ($p > 0.05$).

Based on this result, we used the paired Student's t-test, which is appropriate for dependent and normally distributed samples. The test produced a p-value of 0.273, indicating no statistically significant difference between the two conditions ($p > 0.05$). Therefore, we could not reject the null hypothesis that the use of *Gather.town* does not influence the frequency of entering the flow state.

7.2 Factors Influencing the Adoption and Abandonment of *Gather.town*

Based on interview responses about the use of *Gather.Town* by remote software development teams, key aspects were identified that influenced participants' experiences with the platform. This section outlines main challenges during use, reasons some teams abandoned the tool, and recommendations for teams interested in adopting it. These findings reflect both individual perceptions and organizational dynamics that contributed to the adoption and discontinuation of the platform.

7.2.1 Usage Challenges

Functional limitations of *Gather.Town* were highlighted by participants, particularly regarding asynchronous communication and task management. P05 commented: *"The chat (in Gather) was good for saying things live [...], but for conversations like announcements, links to documents that needed to stay there stored [...], that ended up being a limitation because of that."* Participants also pointed out the lack of features for team work organization. P12 stated: *"We felt that something was missing, like having a kanban tool, a more ac-*

tivity management-oriented tool." P06 reinforced this point by mentioning that external tools were needed during planning: *"When it was time to do planning, we had to use Miro. So, during planning, inside Gather, we shared a screen with Miro."* P13 also noted limitations for practices like pair programming: *"We needed to do pair programming and needed one to control the other's screen. Gather did not help with that, so we opted for NDesk or Parsec."* These reports show that some specific team needs required external tools to complement the work.

Privacy and the feeling of exposure were also mentioned when participants reflected on the limitations of *Gather.Town* in more sensitive contexts. P11 remarked: *"In Gather, I think there is a bit of fear of having a 1:1 with your leadership, and then, you go to a room and someone shows up while you are opening up."* P06 shared a similar perception, reporting insecurity when using other tools simultaneously: *"I had the feeling that [...] I am joining another meeting here with other people and, eventually, I do not know if someone over there will end up hearing or if it will affect some other interaction happening there."* This participant also mentioned the discomfort caused by the constant feeling of being watched: *"It was the feeling that I was not there alone and that I had to stay alert, in case someone called me at any moment"* (P06).

Initial usability issues and environment customization were reported as barriers to adopting *Gather.Town*. Participants described obstacles both in learning the basic features and in configuring the virtual space. P06 mentioned the difficulty in conducting private interactions: *"I had to stay at my desk, and someone could contact me while I was there at the desk. But I did not know how to reply to that person privately, so I ended up responding to the entire group."* P13 reinforced the limitations faced in using the interface by stating: *"I did not know how to read, how to leave a message, or even how to set up the desk."* P01 pointed out specific challenges related to customizing the environment: *"We had some difficulties, for example, setting up a scenario."*

7.2.2 Reasons for Abandonment

Institutional restrictions related to security and standardization of tools were identified as one of the main reasons for discontinuing the use of the *Gather.Town* platform. Evidence suggests that concerns about information security played a central role in the decision to stop using the tool in the workplace. P07 mentioned that the company *"was afraid, since Gather was not a tool the company decided to implement, but rather something teams were using. So, the company was afraid of data leaks."* P04 confirmed this concern by stating: *"They discovered a security flaw in Gather. And then, some confidential information was leaking, it was not safe, and because of that, we had to stop using it."*

In other cases, the prohibition of *Gather.town* use was not limited to security issues but also involved internal governance policies and the use of officially approved tools. P05 commented: *"It was the company's decision (to abandon it), because they wanted something more internal: – 'We are not going to use things from outside the company"'*. Similarly, P06 reported: *"It was a recommendation from our sponsor not to use it, because they recommended using only authorized tools"*. These statements show how internal rules and managerial decisions directly influence the communication tools allowed in the workplace.

In addition, the preference for already contracted and consolidated tools within the corporate environment also contributed to the discontinuation of *Gather.town*. P07 explained: *"The company pays for Teams and Meet, for Google [...] they already asked us to create more, to schedule more meetings in Teams, because we are paying for it."* P07 further noted that, since *Gather.town* was used only by a few teams, it was necessary to maintain communication channels with the rest of the organization: *"we also needed to stay in touch with other people. So, chat was an essential tool, Google Chat. Because people needed to communicate with everyone else at company X. So, it wasn't possible to do that through Gather."*

Limitations of the free plan and costs were also cited as reasons for abandoning *Gather.town*. P01 reported that their team *"used a version of Gather that was free and allowed many people at the same time, and later it limited the number of people."* P01 added: *"The reason we really stopped was that limitation on people and the license, which went from free to paid."* P04 added that the per-user cost made usage unfeasible: *"To pay, it was per person, and it gets expensive."* P09 further explained that as the team grew, the limitation became more critical: *"There was a limitation on the number of members [...]. So, one person had to leave for another to gain access."*

P11 also reported difficulties related to limited access: *"We used it as a team, so we were six people. But then it was going well and we decided to open it to our BU (multiple teams), and then not everyone in the BU could join."* P07 reinforced this institutional limitation by stating: *"There was also the Gather subscription, which we once requested, because [...] we needed more space to include more people from the team. And I imagine that it must have been denied."* These accounts indicate that they adopted Gather.Town at the team level without institutional support. Without budget or backing from the company, subscribing to the paid plan became unfeasible, contributing to its discontinuation.

Natural or cultural discontinuation was also mentioned as a factor tied to internal team dynamics. P01 stated: *"Over time, we started going back to the office more often, with the accumulation of tasks, and then we gradually stopped using it."* P11 described an even more spontaneous process: *"It just lost its hype. Fewer people started joining, and we began to forget about it."* P12 pointed out that the integration among members reduced the need for the tool: *"Over time, that closeness became natural. People started having more contact with each other [...], so people just stopped using Gather, and it was no longer necessary."* These accounts show that abandonment can occur gradually as new routines, bonds, and ways of interacting consolidate within the team.

Negative external perception also appeared as a barrier to continued use. P09 mentioned that the tool was well received within their team, but when adopted by others, external criticism emerged: *"It worked so well in our team that other teams started using it too. And then [...] people looked at the screen and thought it was a little game, and that led*

to the decision to stop using it." P13 noted that, in industrial settings, the visual exposure of *Gather.Town* could cause discomfort: *"Someone from another department or a company director walks by and sees you 'playing' on your screen, which is kind of bad."* These accounts suggest that the visual perception of the tool affected its acceptance in more traditional corporate environments.

7.2.3 Recommendations for Adoption

Encouraging social interaction: Participants recommend the use of *Gather.Town* for teams that seek closeness among members and more agile communication. P07 states: *"if I had to recommend it to a team, it would be more because of the proximity. If you want to maintain closeness, want things to happen faster, and have fast and efficient communication to support daily activities, I think Gather would be a great option."* P11 reinforces this view by noting that the platform *"helped to have a moment of closeness with people that we don't usually have [...] it helped with that bonding, even if just to build a map together, play around, or simply drop by and chat*." P13 adds that *"it's much easier to be there interacting with the person, and not just through their chat"*.

Customize the virtual environment to enhance identity and comfort: Personalization was identified as a way to make remote work more welcoming and to strengthen the sense of collective identity within teams. P07 suggested adapting the space to the team's needs, seeking a balance between functionality and comfort: *"try to bring a bit of the team's vision. So, make everyone comfortable and also see if it meets what you need."* P04 highlighted the importance of individual and customizable spaces, stating: *"this thing about each person having their own space [...] decorating also made everything more enjoyable, we decorated it our own way."* P05 added that using ready-made templates can facilitate space configuration, especially for those unfamiliar with editing: *"maybe there are some templates already available, so I don't think you would need to worry about creating one."* P02 further suggested that the virtual environment should reflect the real-world structure of the organization: *"there must be someone who knows the tool well, to create scenarios according to the company's structure, because it makes people feel more comfortable working in a world they are familiar with."*

Organize the virtual space based on roles, workflows, and privacy: Structuring the environment according to team roles and routines was considered important for optimizing work processes and fostering collaboration. P07 advocated for spatial structuring as a facilitator of interactions: *"if you are having meetings, have a little meeting room, and give everyone their own desk. Also organize, maybe by sector — like, 'Here are the POs, the developers, and the designers' – and then everything becomes easier."* P09 complemented this view by stating that an intentional physical arrangement helps make work more agile: *"maybe actually organize a workspace where people from similar areas stay closer together, for something more agile. And have a real meeting room space, where people take it seriously – 'This is the meeting room, we have to meet here'."* In addition to organization by role and sector, the creation of private spaces was seen as a solution to preserve confidentiality and comfort during sensitive interactions. P11 commented: *"there will be a meeting with just you and another person, and you don't want anyone else coming in, so it's good to have a little corner on the map where only two people can fit. So, I think finding these solutions, getting everyone to agree on them, and following them is important too."* These reports indicate that virtual environments become more effective when they reflect the team's organizational logic and address privacy needs.

Establish clear onboarding and support practices: The initial experience with *Gather.Town* was identified as an important factor for its acceptance and continued use. P07 suggested the presence of someone responsible for guiding new users: *"it would be nice to have a person – not just for that – but responsible for adding new users, managing, and so on. [...] Introducing the platform to the person, explaining what Gather is, how it works, how to join a meeting, and how to call someone."* This support would help reduce technical barriers and facilitate the adaptation process. P04 reinforced this need by reporting: *"it took me a while to figure out how to share the screen. A tutorial would have been helpful."* P06 suggested that an onboarding process would be helpful: *"I believe onboarding would be nice [...], like how to customize, how to create things, what each feature is for, and the rules of that environment. Here is where we have this type of meeting [...], that space over there, if you just want to unwind, to chat about anything, you can use that room."*

Encourage exploration and ownership of the tool: Frequent use, rather than occasional interaction, was recommended as a strategy to better explore the platform's potential. P12 advocated for a more continuous adoption of the platform, stating: *"I would make Gather something not just for a few hours a day or for certain meetings – I would leave it open, leave it running in the background, and move away a bit from Teams, Chat, and use it more."* P11 added that the platform requires some initial effort, suggesting: *"I think you have to give it a try, at least use it for a few weeks forcibly before giving up, because it is nice. But I think it has a bit of a high entry barrier if you don't really commit to using it."* The reports indicate that deeper engagement with *Gather.Town* tends to emerge when users have time and openness to integrate it into their routines.

Adopt *Gather.Town* in coordination with other tools: Integration with existing tools and workplace practices was considered essential for its effective use. P05 suggested a division of functions between platforms, stating: *"I would recommend using Gather for communication, for meetings, but keeping Google Chat or Teams for announcements, pinned communications, and other parts. Because we can't leave everything too loose; there are things that need to be documented, and Gather is not aimed at that, at documenting everything. So, it would need some plus – a Teams, a chat, an email – just to formalize some things as well."* P02 added that during planning activities, their team used other tools alongside *Gather.Town*: *"...for example, when doing the planning, we needed to use Miro."* According to the reports, the use of *Gather.Town* is recommended in a complementary manner. Its articulation with other tools is especially indicated for activities involving documentation, tracking, or structured organization.

Adjust playful elements according to the team profile: The platform's playful aesthetics were perceived as a possible distraction, especially when not aligned with the team's preferences and work culture. P09 suggested limiting recreational elements, stating: *"maybe don't add little games, because, like it or not, the space is already somewhat interactive and playful. Adding more games would just reinforce that stereotype."* P13 highlighted the risk of distraction, particularly in teams more susceptible to losing focus: *"depending on how distractible your team is, Gather can become distracting because of the number of things to do in it – the games and so on."* The findings indicate that balancing the playful elements with the platform's functional use, such as meetings, communication, and task coordination, should consider the team's profile and intended purpose.

8 Discussion

This section presents a discussion of the results, addressing the specific objectives defined in Section 1. The first subsection explores participants' perceptions of *Gather.town* in terms of ease of use, communication, collaboration, presence, and flow. The second subsection discusses aspects related to social interaction among team members. Finally, the third subsection brings together insights corresponding to the third and fourth objectives, discussing both the challenges identified and the recommendations for improving the platform's adoption and use.

8.1 Perceptions of Metaverse Use in Remote Work

The results of this study confirm and extend previous findings on the use of metaverse platforms in work environments. Participants reported positive experiences with *Gather.town*, highlighting aspects such as ease of use, communication, presence, and support for experiencing the flow state. These factors are also linked to user engagement and satisfaction in the metaverse experience, as noted by Roh et al. (2024). However, some participants pointed out limitations, such as difficulty maintaining concentration due to environmental distractions, indicating that the platform's benefits may vary depending on the nature of the task.

The literature has already pointed out social presence and agility in communication as valued attributes in metaverse environments. Studies such as Lee et al. (2023) and Sriworapong et al. (2022) highlighted these aspects in educational contexts. They emphasized the role of *Gather.Town* in promoting fast collaborative interactions. Similarly, data from this study indicate that software professionals also perceived these characteristics positively. Participants emphasized communication ease and informal interactions as factors that foster team cohesion and agile problem-solving.

In addition, the perception of social presence was reinforced by the ability to see colleagues, navigate shared spaces freely, and engage in spontaneous interactions. This virtual environment helped make the remote experience more closely resemble the dynamics of a physical office. The presence of informal areas, such as break rooms and gaming spaces, was also identified as a factor that strengthened interpersonal bonds. These environments promoted integration, relaxation, and a greater sense of closeness among team members. These findings corroborate the results of Palos-Sanchez et al. (2023), who identified *Gather.Town* as an effective resource for increasing proximity and engagement in remote and hybrid work contexts.

Participants' accounts revealed indications of experiencing the flow state, especially in situations that required real-time doubt resolution. This type of interaction supported immediate feedback and sometimes led to a loss of time awareness during task execution. However, the virtual environment also introduced elements that compromised concentration. Frequent interruptions or unexpected interactions were not always welcome, especially when participants focused on activities requiring sustained attention.

Finally, the quantitative analysis (Section 7.1) supported the qualitative findings regarding participants' perceptions of the flow state. Although we identified no statistically significant difference in the self-reported frequency of entering the flow state between the conditions with and without the use of *Gather.Town*, the mean was slightly higher in the condition without the tool. This result suggests that although *Gather.Town* offers features that support flow, it may also introduce obstacles. Visual distractions, interruptions, and sensory overload were mentioned as factors that may hinder sustained immersion. These findings highlight the importance of balancing social interaction and individual focus, especially in complex and cognitively demanding tasks such as software development.

8.2 Social Interaction Mediated by Metaverse Environments

Participants identified social interaction as one of the main differentiating factors of *Gather.Town*. The ability to initiate spontaneous conversations, visualize colleagues, and engage in quick interactions made the remote experience more similar to that of an in-person environment. The active presence of team members in the virtual office created continuous coexistence, which contributed to engagement and a sense of belonging.

According to Ritonummi et al. (2023), elements such as teamwork, mutual respect, information exchange, and collaboration are facilitators of deep engagement in activities. In the context of this study, *Gather.Town* enabled these interactions and reinforced the social aspect of remote work, making the experience more enjoyable and immersive. However, tension was observed between continuous collaboration and the need for focus. Proximity and ease of contact, although beneficial for rapport, led to frequent interruptions, especially when there was no clarity about colleagues' availability.

8.3 Usage Barriers and Recommendations for *Gather.Town* Adoption

This study also identified barriers that negatively impact the adoption and continued use of *Gather.Town*. Technical limitations were reported as obstacles, such as the restriction of ten simultaneous users in the free version and the discomfort

caused by prolonged headphone use. Although operational, these aspects influence the overall user experience and may affect the perceived value of the platform.

This variation in perceived experience quality is particularly relevant. According to Roh et al. (2024), satisfaction with the metaverse is positively associated with the intention for continued use. The data from this study reinforce this relationship. Professionals who had pleasant experiences, with proper support and ease of use, expressed interest in continuing to use the tool. In contrast, participants who encountered difficulties or reported less satisfactory experiences showed less willingness to use *Gather.Town* again.

These findings highlight the importance of well-structured environments, with technical support and initial training. These factors are essential to promote adherence and continuity in using the platform. Such actions increase the chances of a satisfactory experience, which supports engagement and reduces the likelihood of abandoning the technology (Roh et al., 2024).

9 Lessons Learned

The following section presents the main lessons learned throughout the study, aiming to provide practical and applicable recommendations for software industry professionals. The goal is to synthesize key insights in order to support decision-making and the improvement of practices in similar contexts.

Social Integration and Enhanced Collaboration: The use of metaverse platforms such as *Gather.Town* has proven effective in increasing the sense of presence among members of remote teams. This virtual presence contributes to more fluid and natural communication, which fosters a more collaborative and cohesive work environment (Park et al., 2023). Additionally, the ability to visualize and interact with colleagues in a simulated environment helps build interpersonal relationships. These relationships are essential for ensuring effective teamwork (Olson and Olson, 2000; Palos-Sanchez et al., 2023). A recommended practice is to remain online throughout the workday. Using status indicators when stepping away helps maintain communication continuity and prevents unnecessary interruptions.

Impact on User Motivation and Satisfaction: Social interactions facilitated by the metaverse, such as greeting colleagues with a simple avatar wave, positively impact users' motivation and satisfaction. These interactions reduce the feeling of isolation by allowing users to see their colleagues online, providing comfort and satisfaction (Park et al., 2023; Bailey and Kurland, 2002). When team members see their peers connected and working, they feel closer and more engaged, which promotes collaboration (Lee et al., 2023; Dourish and Bellotti, 1992). This sense of connection motivates them to contribute to the team effort and share ideas, reinforcing the spirit of collaboration (Morrison-Smith and Ruiz, 2020; Dourish and Bly, 1992).

Increased Mutual Awareness: The ability to visualize colleagues' activities and clearly understand their availability and engagement fosters trust and facilitates collaboration. This transparency reduces uncertainty and prevents conflicts (Morrison-Smith and Ruiz, 2020; Dourish and Bly, 1992; Dourish and Bellotti, 1992). Knowing what each person is doing and when they are available allows team members to communicate more effectively. It prevents duplicated work and enables quicker problem resolution (Park et al., 2023; Mortensen and Hinds, 2001). One effective practice is to hold meetings in specific rooms within *Gather.Town*. This approach simulates a physical environment and helps maintain organization and focus.

Usability and Adaptation Challenges: The user experience with the *Gather.Town* platform varied among participants. Some faced initial difficulties adapting to the interface and features, especially those without prior gaming experience. However, over time and with colleagues' support, most participants could use the platform effectively. It is possible to mitigate this through support and training strategies such as video tutorials and step-by-step guides. Creating a mentorship culture in which experienced users assist newcomers also facilitates adaptation. Finally, tailoring training to generational differences and levels of technological familiarity makes the transition process more effective.

Balancing Connectivity and Focus: One challenge identified was balancing the constant connectivity provided by the metaverse with the need for focus in complex tasks. Remaining constantly available and online can disrupt activities that require deep concentration. Therefore, allocating specific times for social interaction and other for focused work is important. This approach ensures collaboration without compromising individual productivity.

Participant Limitations: The limitation on the number of participants in the free version of the *Gather.Town* platform was a drawback for users. It indicates the need for additional investment to support larger teams. However, investing in the paid version may be worthwhile if the goal is to go beyond standard communication and strengthen team cohesion while simulating in-person interactions. This investment maximizes the benefits and meets the needs of larger teams, promoting transparency and collaboration in the remote work environment.

10 Limitations

One of the limitations of this study relates to the formulation of the questionnaire questions and interview scripts. There was a risk that these questions might not adequately address the essential aspects investigated in this research. To mitigate this limitation, all questions were reviewed by a specialist in the field of software engineering, who conducted a detailed review and provided useful feedback for refining and defining the questions.

The number of participants in the study can also be considered a limitation. To mitigate this impact, professionals from three different software industries were selected, with varied profiles in development teams (Table 1) and prior experience in metaverse environments. Furthermore, according to ACM's empirical standards (Ralph et al., 2021), this study is characterized as a *Qualitative Survey*, where statistical generalization is not expected. Thus, the sample of ten participants is considered acceptable.

To ensure the reliability of the qualitative results, we adopted a peer review process. Two specialists in the field reviewed all codes and categories generated by the first author of this research. This process ensured that the codes accurately reflected participants' quotations, that the categories were well grounded, and that the structure of the analysis respected the logic and the collected data.

The flow evaluation was based on simple self-reported measures, using a 0-to-5 scale and direct questions. This approach may not capture all the subjective dimensions of the construct. To mitigate this limitation, a definition of flow was presented to participants before the evaluations. Additionally, qualitative and quantitative methods were combined, with semi-structured interviews based on theoretical flow dimensions. This methodological triangulation reinforced the validity of the interpretations.

Another limitation of the study refers to the potential imprecision of responses regarding the flow experience, since the information was collected through retrospective participant reports. To mitigate this limitation, in addition to introducing flow-related concepts immediately before the interviews, we also used simple numerical scales during the interview to facilitate the estimation of the frequency of entering flow, systematizing responses for comparative analysis. This approach minimized memory distortions and ensured consistency in the collected information.

Finally, the evaluation based solely on the *Gather.Town* platform is highlighted as a limitation of this study. Although several metaverse platforms could have been used in this research context, recent studies highlight *Gather.Town* as an effective platform for remote work among distributed teams (Park et al., 2023; Palos-Sanchez et al., 2023).

11 Conclusion

This study reports how the use of metaverse environments affects the experience of users working in remote software development teams, as well as the factors that influence their adoption and abandonment. It involved thirteen professionals from five software companies. All participants had prior experience with the *Gather.Town* platform, having used or currently using it in their activities.

The contributions of this research can influence the dynamics of remote software development teams. The results show that the use of metaverse environments can enhance social interaction, the sense of presence, communication, and collaboration. As highlighted by Hayward Andres (Andres, 2002), software development depends on the ability of collaborators to communicate efficiently, share knowledge, and exchange information in a transparent and collaborative manner.

These findings suggest that adopting metaverse technologies can positively influence organizational culture of remote teams. It promotes closer and more meaningful connections among team members and improves the efficiency of activities related to software development. By providing a more immersive and interactive experience, metaverse environments have the potential to mitigate limitations of traditional remote work, such as social isolation, communication delays, and distrust in colleagues' contributions. Understanding and exploring the potential of these environments may represent an important step in the evolution of remote work practices, offering new perspectives for collaboration and productivity in distributed teams, while also encouraging innovation and adaptation to the demands of an increasingly digital world.

Additionally, it was observed that the communication ease provided by metaverse environments can support the experience of flow during remote work, particularly by enabling the immediate resolution of questions. However, the interactive nature of these environments can also lead to distractions, interruptions, and loss of concentration, compromising the continuity required to sustain flow. Furthermore, several factors were identified as influencing the abandonment of metaverse platforms, including organizational restrictions, security concerns, usability difficulties, and platform limitations. To improve adoption, it is recommended to customize the virtual environment according to team needs, integrate it with existing workflows, provide onboarding support, and establish clear objectives for its use.

Finally, due to the small sample size, it was not possible to perform a segmented analysis by company type. As a continuation of this work, it is suggested to explore this approach in order to understand whether metaverse dynamics impact companies differently depending on their size or sector. This would deepen the understanding of the effectiveness of metaverse environments as an alternative to enhance the work of remote software development teams.

Data Availability

The complete set of instruments, raw data, and annotated documents used in this study is available as supplementary material at the following link: Figshare.

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