A decade of evolution in project leaders onboarding process at a global software company

a case study

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ABSTRACT

CONTEXT: The software industry, characterized by its high turnover and constant change in its production process, also demands continuous improvement in its newly hired employees' onboarding and training processes. **OBJECTIVE:** This work investigates how the onboarding and training processes for new employees in the project leaders department evolved over a decade. **METHOD:** We employed a descriptive case study, using interviews, an electronic questionnaire, and document analysis to examine the transformation of fundamental aspects such as (i) learning strategies, (ii) support materials, (iii) guidance and mentoring, and (iv) the impact of the onboarding process on the emotional states of newcomers. **RESULTS:** The results highlight the importance of guidance and mentoring to consolidate knowledge shared through training, self-study, and experiences in applying the problem-based learning approach. Furthermore, given the dynamic and evolving nature of the software industry's production processes, it presents the challenges of creating and maintaining support materials to aid the onboarding process. Finally, the onboarding process's impacts on newcomers' emotional states are presented. **CONCLUSION:** Effective management of critical factors can foster a learning environment that facilitates the development of skills and abilities more efficiently, promotes emotional well-being, reinforces self-efficacy, and increases newcomers' productivity. By recognizing the interdependence of these elements, organizations can develop more integrated and flexible training strategies, optimizing the development trajectory of newcomers.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in collaborative and social computing**.

KEYWORDS

Onboarding process, Team formation, Training process

1 INTRODUCTION

Software development is an organized thrive on delivering products in faster, better, and cheaper ways [26]. The software industry, responsible for creating and maintaining technological solutions, depends on the development team to produce their deliverables and struggles with talent acquisition and low retention rates [31]. The faster these employees feel prepared, included, and welcome in their jobs, the faster they will be prepared to contribute to the company's success [5].

Keeping its employees productive and motivated is a way for the company to guarantee professional retention and survival [33]. To mitigate the challenges generated by the high turnover rate in this sector, some companies are using the onboarding process to accelerate the ramp-up of new members [23]. This process helps new employees adjust quickly and smoothly to the social and performance aspects of their new jobs and become productive quickly[4].

1.1 Motivation and Contributions

While agile teams adopt self-managed teams [17], more traditional teams use the role of project manager or project leader (PL) [24]. In matrix organizations, PLs need to reconcile the demands of their projects and the demands of their department, which relies on the knowledge and commitment of software developers to deliver quality products [18]. Unlike other roles such as squad leader, system analyst, developer, tester, etc., the PL role requires technical management knowledge and interpersonal soft skills related to communication, leadership, planning, and organization, among others [14].

Training a beginner to fulfill the role of Project Leader in the software industry is not trivial. Studies on the onboarding process address the roles of developers [27], testers [23], and team members in general [16], but no paper has sought to analyze the onboarding process from the point of view of project leaders. Therefore, this paper presents a case study on the onboarding process of a R&D&I company that that develops technological solutions embedded in Android [1] smartphones and tablets in a global scale.

Effective onboarding is crucial [7] for ensuring new project leaders are well-prepared for their roles, contributing to organizational success, and addressing the challenges of the competitive Software Industry market [34]. By collecting experience reports and opinions from employees in the project leaders department who participated

[1] https://www.android.com/

in the onboarding process, which was applied and evolved over the past decade, this paper presents the changes implemented in learning strategies, support material quality, guidance, and mentoring during this period. Furthermore, we discuss the challenges faced and the emotional impacts of the onboarding process on investigated participants.

2 BACKGROUND AND RELATED WORKS

When an organization hires a new software development team member, it is essential to integrate this individual into the organization, its processes, and its culture. This involves granting the necessary knowledge, skills, and behaviors to succeed in their new role [5]. Typically, this member integration occurs through an onboarding process [31]. The goal of onboarding is to transform individuals from organizational outsiders into productive and integrated members of the organization [30]. In informal onboarding, newcomers learn about their new job without a structured organizational plan. In contrast, formal onboarding involves assisting these individuals through a formal and explicit set of policies, procedures, and coordinated actions [37]. Some studies explored the onboarding supported by a boot camp program [7] to accelerate the formation and integration of new members.

The topics and issues addressed by studies on onboarding in software industry companies are quite varied. Some studies focus on the experiences of newcomers in automated testing teams [23], agile development teams [9], startups [25], and large distributed software projects [8]. There are also investigations into remote onboarding during the pandemic [27] and how IT project managers use knowledge sharing to integrate new employees [32].

While some studies discuss onboarding strategies [16], others explore success factors in the onboarding process more generally [31], or specific factors such as compliance, clarification, culture, and connection [4], corporate welcome, manager welcome, coworker welcome [11], aspects such as learning, confidence building, and socialization [16], perceived utility, organizational commitment, organizational support, job satisfaction [20], orientation, socialization, task characteristics, and leadership, the role of mentoring [13], onboarding experience [15], and emotional impact [10].

Although these studies provide insights into different contexts, none have addressed onboarding project leaders working in a global development company [19] that employs a weak matrix organization [24] composed of functional departments. According to PMI [24], this scenario presents additional challenges related to the lower level of authority and influence of project leaders compared to functional managers. Furthermore, none of the studies analyzed how the combination of learning strategies, the quality of support materials (wikis, videos, and learning roadmaps), and the guidance and mentoring provided by senior staff impacted the emotional states of newcomers during the onboarding period.

3 METHOD

The method adopted in this study supported the understanding of the evolution and identification of opportunities for improvement in the onboarding process in the project leaders department of a software company. Our research specifically addresses the question: How has the evolution over a decade of critical factors such as learning strategies, support materials, guidance, and mentoring impacted the effectiveness of the onboarding process and the emotional states of newcomers to the project leader department? Through the findings, we aim to design future strategies to optimize this process further. To achieve this objective, we used a descriptive case study method [36] composed of six steps, as illustrated in Figure 1.

The environment. This research was conducted within a department of a large software development corporation, which employs more than 1000 individuals. Despite being situated in Brazil, it works in a global software development environment that involves collaboration with national and international units to develop and maintain Android embedded binaries in mobile smartphones. The company employs a weak matrix organization [24] where project managers have lower authority and influence than functional managers. Unlike a projectized organization [24], only the project leader (PL) is directly assigned to the project. Meanwhile, other departments provide a pool of resources that executes all other software development activities requested by PLs. These resources are organized into departments of 40 to 100 members based on specialization areas, such as analysts, developers, testers, quality assurance professionals, product managers, etc. The PL department is in charge to manage four main project categories: (i) New Models, (ii) Operational System (OS) Upgrade, (iii) Security Maintenance Releases (SMR), and (iv) Full Maintenance Release (FMR) [18]. The first category of projects has an average duration of 6 months and aims to develop new binaries to be shipped from the factory in smartphones that our customers intend to launch on the market. The other three categories (OS Upgrade, SMR, and FMR) have an average duration from 3 to 6 months and aim to maintain the currently embedded binary up-to-date with security or new requirements.

The studied case. At the moment of the selection phase (Step 1), the phenomenon had already impacted the project leader's department for the last decade. It seems to be recurring and necessary to keep training new members of the project leaders department. Both the method applied in the research and the expected results have great potential for replicability and extrapolation to other areas of the company and software engineering area. Despite its impact, stakeholders lack a comprehensive understanding, hindering improvement efforts. A deeper insight into this phenomenon could enhance working conditions, satisfaction, productivity, and project quality. This industrial-scale case could also guide other software industries facing similar challenges. The phenomenon studied by this research is the evolution experienced by four aspects of training new members in this department: learning strategies, support material, guidance and mentoring, and the influence of emotional states.

Data collection. After choosing the case study, we looked for related works (Step 2) that could provide a theoretical framework (see Section 2). We then analyze the characteristics and impacts of the case to support the definition of questions, population, and data collection techniques (Step 3). In this phase, we conveniently conducted a focus group meeting with a manager and four coordinators, during which we gathered initial information. This included the number of individuals who have undergone an onboarding process in the last decade, how many are still employed by the company, and the various developments the process has undergone.

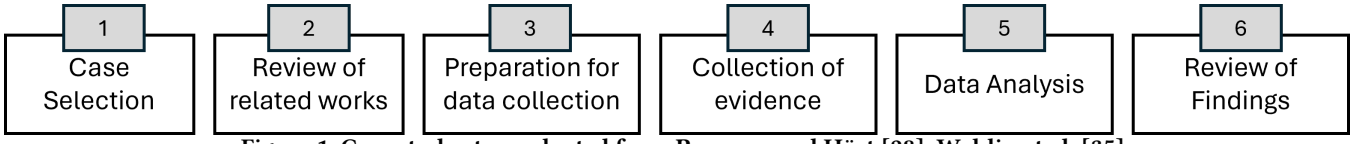

Figure 1: Case study steps adapted from Runeson and Höst [28], Wohlin et al. [35]

Based on this first iteration, we discovered that the last group of newbies had participated in a boot camp program as a new onboarding strategy never used before in this department, where everyone would be part of a single team led by a coordinator and two squad leaders. This boot camp adopted the Problem-Based Teaching (PBL) approach [22], and it lasted three months. Based on this information and findings presented in related works, we defined a semi-structured interview script [28], divided into questions for people who implemented the training and those who received it, as shown in Table 1.

Interview script to Tool Guild Leader
1) Qual foi a motivação para formar a guilda de ferramentas?
2) Quais foram as principais lições aprendidas ao longo da jornada de desenvolvimento?
3) Como a adoção da metodologia MVP afetou o processo de desenvolvimento de software?
4) Quais foram as vantagens e desvantagens das arquiteturas Script, Desktop e Web com base nas perspectivas do usuário, dos desenvolvedores e da entrega de valor?
5) Como a guilda de ferramentas pode melhorar o processo de desenvolvimento de software e alcançar maior produtividade?
Itinerary for apprentices who participated in the bootcamp
1. Tell us about your first week on the team. What did you do? What guidance did you receive?
2. Were you informed about a) what the boot camp dynamics would be like? b) How would it last? c) What would be taught? d) What would the release process be after the onboarding period?
0 3. Talk about a) support material, b) dynamics between apprentice and instructors, c) on-the-job approach
4. What factors/situations helped or hindered your learning curve?
5. What factors/situations helped or hindered your self-efficacy curve?
6. How did you feel (knowledge/self-efficacy) when you joined a new squad?
7. What would you improve in the dynamics (teaching/learning methodology) for a new PL training cycle?

Table 1: Interview script

From Feb/19/2024 to Feb/27/2024, divided into 5 group and individual interview sessions, we interviewed 12 people as shown in Table 2. These people, selected for convenience, were involved in this boot camp. Every interview had the participation of at least 2 researchers and at least 1 interviewee. While one of the researchers played the role of the main interviewer, the other researchers provided support in recording the audio, taking notes of key points, and asking extra questions to the interviewees. After every interview, we did a review meeting to evaluate the findings raised and our conduct as interviewers. Powered by Galaxy AI [29], we recorded the interviews using an S4 smartphone and used both the transcription and the automatically AI-generated summaries.

Session	Date	Interviewees	Total
1	Feb/19	1 Coordinator (pilot)	1
2	Feb/22	1 Squad Leader (SL) + 1 Project Leader (PL)	2
3	Feb/23	2 Project Leaders	2
4	Feb/26	5 Project Leaders	5
5	Feb/27	1 Squad Leader + 1 Project Leader	2
Total 5	2 Weeks	1 Coordinator + 2 SL + 9 PL	12

Table 2: Semi-structured interviews schedule

The interviewees' testimonies revealed unknown artifacts (documents and internal reports) by the research team. They supported the preparation of a questionnaire that allowed us to carry out a detailed survey of the department's current employees. The team is diverse, including members who have been part of the company since 2012 and others with less than a year of experience who participated in the last boot camp, totaling 53 individuals. Five were absent on vacation or sick leave during the data collection window. Therefore, from March 4 to 11, 2024, we made the questionnaire available electronically and received 48 responses. To capture the evolutions implemented, we conducted a new focus group meeting with a manager and four coordinators, selected by convenience, to break down periods that could reflect phases of evolution in the onboarding strategies employed in the project leaders' department.

In Table 3, we present the five identified periods (P1 to P5) grouped by proximity to the admission date, which serve as a basis for comparing the elements analyzed in this research. The admission dates were purposely omitted due to a non-disclosure agreement. Despite using admission date proximity as the criterion for group formation, random turnover made it impossible to divide the groups symmetrically. For example, 35% of the individuals were concentrated in 2020, and there were no representatives from 2014. However, we claimed that this division represented onboarding styles predominated in each period.

Period	Number of employees
P1	9
P2	16
P3	8
P4	8
P5	7

Table 3: Grouping by admission date

After clarifying that the 'onboarding period' is composed of providing newcomers with essential information about the company, its policies, and culture, defining their roles, and delivering the necessary training to perform their daily activities effectively, ultimately becoming productive team members, we applied the questionnaire, presented in Table 4, that covers a wide range of topics related to the onboarding experience, support, and performance of new department members, as well as the use of learning materials and resources.

Data extraction and analysis. With the interviews and questionnaire results added to the artifacts found (videos, chats, and emails), we performed data extraction and analysis (Step 5). Based on the Social Cognitive Learning (SCL) theory [21] and application of content analysis [3], we identified the following perspectives: learning strategies, support materials, guidance and mentoring, and the impact of the onboarding process on the emotional states of newcomers. These perspectives corroborate with [18] who state that the learning curve of new Project Leader team members toward fluency in their daily activities is affected by the combination of four main factors: (i) the definition and availability of the content to be learned, (ii) the individual pace and preferences of learning,

Characterization of individuals
ID, email, admission date, degree level, previous experience in the IT area, seniority when hired
About Training and Support
1. In your opinion, how long did your onboarding period last? 2. Did you be informed: What are the goals related to content absorption? What are the goals for acting as a project leader (PL)? What does the PL do? 3. What was the Learning Path like? 4. What were the Wiki posts like? 5. What were the recorded content videos like?
About the Support Received
6. Who supported your onboarding? 7. Did the person have good teaching skills? Was the person helpful? Did the person have empathy? 8. Did it make you feel safe to ask questions and carry out activities? 9. Choose the best option that describes the support provided by your mentor: a) he/she never had time to provide support due to project demands. b) even with the high demand, he/she found time to provide support c) with average or low demand, he/she found time to provide support 10. Did the mentors use the wiki as a reference to pass on knowledge? 11. Were the mentors confident in what they taught? 12. Did the mentors provide positive and constructive feedback? 13. Did the mentors go through most of the content in an order that made sense? 14. Did the mentors apply techniques to evaluate your learning?
About the Use of Materials and Resources
15. Did you use internal wiki, videos of recorded meetings, videos of recorded content, your notes, or other people's notes as support material? 16. What type of project did you practice on? a) real, b) simulated or mocked, c) deactivated What did you spend your time on during the first week of onboarding? 17. Did I feel that the content shared had a chronological order? 18. Did you receive training with content that was not useful for the phase you were experiencing? 19. Did you receive training with random content?
About Experience and Feelings
20. What positive or negative feelings did you feel during the onboarding period? 21. Describe the onboarding situations that triggered the feelings you cited.

Table 4: Questionnaire sections and content

(iii) opportunities to gain experience, and (iv) the way to share knowledge.

The four sources of self-efficacy identified in SCL theory – mastery experiences, observational learning, receiving feedback, and physical and emotional states – helped us understand several key aspects. These include how new project leaders observe and imitate mentors and colleagues, how support materials facilitate knowledge transfer and provide feedback, and how guidance and mentoring consolidate knowledge and increase self-efficacy through positive reinforcement. Finally, these sources provided insights into how the onboarding process affects new leaders' emotional states, which are influenced by these aspects and their self-efficacies.

We employed the ATLAS.TI tool [2] for sentiment analysis of open-ended questions and interview transcripts, comparing these with responses related to positive and negative feelings experienced during the onboarding process.

After transcribing and summarizing the interviews, four researchers (divided into two pairs) applied content analysis to identify patterns and themes. Each pair analyzed the transcriptions of three randomly chosen interviews to identify critical onboarding factors: learning strategy, support material, and guidance and mentoring. These findings were compared with the works of Lima et al. (2021) and Bandura (1977). We also identified the emotional impact of the onboarding process as a critical factor. In Table 5, we present the codebook that was developed for these four factors used to extract key insights from interview transcriptions.

Code: Learning Strategies
Definition: Techniques and approaches used to facilitate learning for new project leaders. **Examples:** "I learned a lot by observing my mentor's approach to problem-solving and decision-making." "The PBL sessions were challenging but immensely helpful in understanding real-world applications."
Code: Support Materials
Definition: Resources provided to assist new project leaders in their learning process. **Examples:** "The internal wiki was a great resource for quick references and detailed explanations." "Recorded training sessions allowed me to revisit complex topics at my own pace."
Code: Guidance and Mentoring
Definition: Support provided by experienced individuals to guide new project leaders. **Examples:** "My mentor was always available to answer questions and provide feedback, which was crucial for my development." "Having a dedicated mentor made a significant difference in my onboarding experience."
Code: Onboarding Process Impact on Newcommers' Emotional States
Definition: The effect of the onboarding process on the emotional well-being of new project leaders. **Examples:** "I felt anxious at first, but the supportive environment and positive feedback helped me gain confidence." "Receiving constructive feedback and encouragement made me feel valued and motivated."

Table 5: Codebook items

After the analysis, we held a results consolidation session involving the researchers and the interviewees. The result of this analysis, combined with information collected in the focus group session, supported the creation of the electronic questionnaire we applied to the project leader department members who participated in the onboarding process over the past decade. For the questionnaire analysis, we performed frequency analysis and cross-referenced the responses with the 5 periods (P1 to P5) grouped by proximity to the admission date to identify when and what evolutions in the onboarding process occurred, as well as which characteristics remained.

Findings review and presentation. After summarizing the analyzed data, we ran three "findings review sessions" (Step 6), inviting everyone who participated in the interviews or responded to the electronic questionnaire (a total of 60 people). Due to the number of people involved and the expected audience, we held this session remotely to give everyone the opportunity. In this section, we had the participation of 45 (75%) people. The transcription of this session served as an extra source of data to review our findings so far.

4 RESULTS

In this section, we will present the evolution in the factors (i) learning strategies, (ii) support materials, (iii) guidance and mentoring,

[2] https://atlasti.com/

and (iv) the influence of the onboarding process on newcomers' emotional states.

4.1 Evolution of learning strategies

The interviews indicated an evolution in the company's training approaches. Initially, new employees were onboarded without any formal training, with the expectation that, over time, they would begin to contribute effectively. This practice evolved into the implementation of specific training sessions conducted by different departments of the company. The evolution culminated in the adoption of an immersive onboarding process, representing a significant advance in the preparation of newcomers.

A decade ago, the project leadership department operated under the premise that the simplest processes did not require formal training. The expectation was that newcomers, with the support of more experienced colleagues, would become productive within six months to two years. However, as processes have become more complex, the need to accelerate newcomers' productivity has intensified, reducing ramp-up time to six months to a year.

In the company's matrix structure, where project leaders must interact with multiple departments to guarantee product delivery, the company adopted specific training provided by these departments. Although this approach expanded newcomers' understanding of how the company operated, the content often did not meet the specific needs of their roles, serving more as general information than practical support.

As training needs expanded, the team began organizing in-person group sessions. The lack of recordings, however, required repeating these sessions for new participants, challenging the efficient dissemination of knowledge.

The COVID-19 pandemic in 2021 [12] accelerated the transition to remote work, transforming in-person training into virtual training, with the added benefit of being recorded. This included meetings covering everything from procedures and concepts to organizational culture, making these recordings a valuable learning resource.

However, the quality and effectiveness of the training material faced obstacles, such as the unnecessary length of videos that covered content that was not very relevant to beginners. For example, long videos that devoted a small fraction of time to essential content demonstrated the need to align training resources with learners' real needs.

Although well-intentioned, the direct allocation of newcomers in existing teams often resulted in insufficient mentoring due to the lack of time from senior professionals (potential mentors) due to the demands of their day-to-day activities. As an innovative solution, a dedicated team of newcomers was formed under the tutelage of an exclusive mentor who was also a project coordinator. This mentor organized the training content into themes, although the pressure of projects still limited his ability to devote full attention to mentoring.

To further improve support for newcomers, a coordinator and two team leaders guided a group of 20 newcomers. Despite the adoption of a problem-based learning approach using real projects, learning difficulties persisted, highlighting the disadvantage of introverted participants in relation to more extroverted ones and the continuous limitation imposed by the project demands on the availability of mentors.

This report highlights the continuous journey of improvement in the training and integration of new employees, highlighting the importance of constant adjustments to face emerging challenges and effectively meet the needs of apprentices. Here, we see the challenge of aligning the need for time for mentoring versus the daily demands of the projects to be delivered. Rebalancing the amount of work demanded by mentors and other team members so that they can dedicate themselves to mentoring without harming their activities or their apprentices is suggested as a point of improvement.

4.2 Evolution of support materials

Through testimonies from interviewees and documentary analysis of recorded meetings and training material, we identified an internal wiki, videos, and learning roadmaps as the main support materials in the onboarding process. Below, we will present the evolution of these resources amid challenges related to their perishable nature and the need for constant updating.

In an attempt to concentrate explicit knowledge and improve knowledge sharing, since 2012, the company has invested in the creation and maintenance of an internal wiki, which serves as a repository of posts related to concepts, roadmaps, and guidance regarding the execution of its software development process. The evolution of this wiki, shown in Figure 2, shows the persistent difficulties in keeping the content updated and complete, as in all periods there was the reporting of subjects without posts and outdated posts. However, simple posts were eradicated, giving more and more space to posts considered complete and of good quality.

The structure and organization of posts have also undergone improvements over the years [6]; this has improved access to posts and the use of this as an alternative resource for sharing knowledge. For its users, the Wiki does not serve as a roadmap for learning, but it is a valuable tool for quick reference for specific knowledge. To keep the posts up to date, the company encourages its employees to use and update the posts during the onboarding and training process, and when carrying out their daily activities.

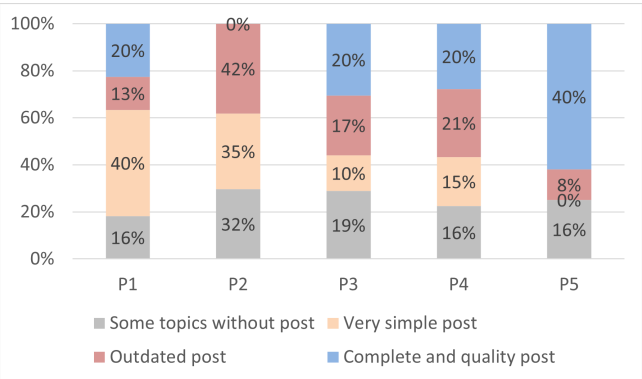

Figure 2: Evolution of wiki quality

Standalone videos or recorded remote meetings came into existence in response to the lockdown imposed by the Brazilian Ministry of Health in response to COVID-19 [12]. As shown in Figure

3, during this period, we began to intensify remote meetings and training, where some, due to being recorded, ended up becoming support materials. However, the videos were very long-winded, making them very costly to use and demotivating users. There was also an attempt to create videos focused on specific content, but the superficiality and prerequisites for understanding what was in the video were also a factor demotivating its use. Good quality videos, highlighted by P4 participants, are 10 to 30-minute videos that make up a knowledge trail with sequential videos.

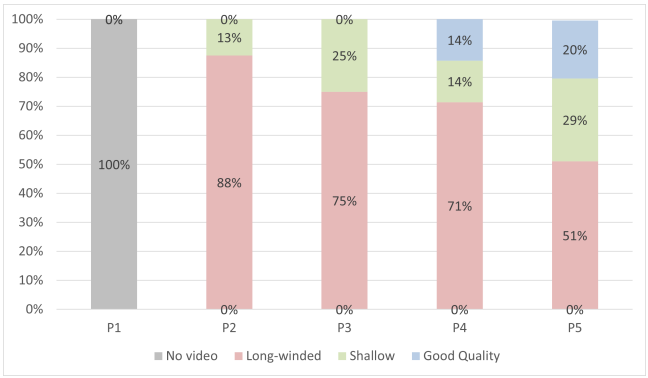

Figure 3: Evolution of video quality

The learning roadmap for a given content serves both the mentor and the apprentice. The lack of a structured roadmap and the use of randomly organized content highlights a gap in the evolution of these support materials. However, in Figure 4, we observed an increase in the use of roadmaps with grouped content, representing an improvement over randomly organized roadmaps. Despite having the option to select "chronologically organized onboarding" no one chose this option, indicating that the roadmap with grouped topics was considered the best available option over a decade of onboarding in this department.

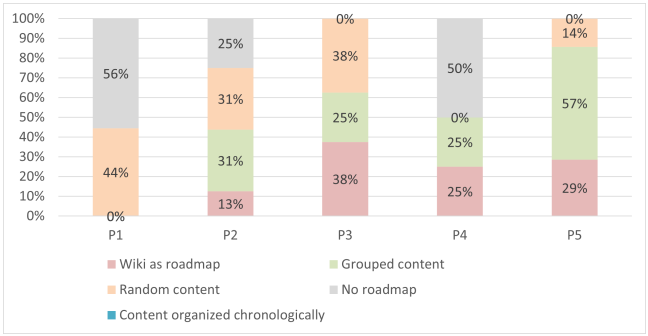

Figure 4: Evolution of learning roadmap quality

By working with supporting materials digitally, the cost of printed material is reduced, but it does not eliminate the need for constant updating and the possibility of obsolescence. However, we can use the onboarding and training process for newcommers to ensure the use, review, and updating of this material.

4.3 Evolution in guidance and mentoring

As for the strategy related to defining one or more mentors, it was not possible to perceive an evolution on a chronological basis. Both for people admitted alone (42%) and for people admitted in groups (58%), the types of guidance offered were quite distributed. As shown in Figure 5, almost a third of people did not have a formalized mentor (27%), who informally turned to more experienced colleagues to resolve their doubts or obtain guidance. The majority had shared mentors (59%). Among those who had multiple mentors, there was a perception of reduced commitment on the part of mentors, under the assumption that others were available (48%). Among those who had a shared department (42%), this faced the challenge of reconciling the demand for daily project activities and the demand coming from newcomers. Some newcomers admitted individually to the company received personal mentoring from one (4%) or several mentors (10%), but this is not a standard. During the interviews, we discovered that this group was people who joined the teams directly without a prior training process. Thus, they ended up acting as assistants to senior project leaders and thus acquiring experience in activities as demands arose.

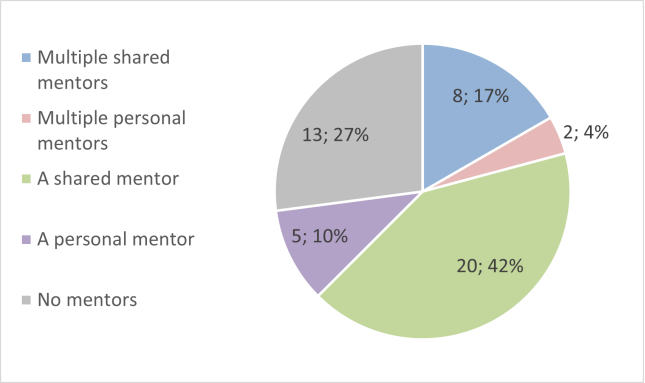

Figure 5: Mentoring support

Due to the absence of formal behavioral guidelines and goals established for mentors, their performance depended significantly on their personal initiative and ability to establish effective connections with newcomers. However, according to feedback from respondents, the individuals assigned to mentoring demonstrated didactic efficiency (67%), conveyed confidence in the knowledge they shared (78%), in addition to encouraging novices in carrying out tasks (81%) and in formulating questions (75%). However, the main criticisms highlighted were: (i) the absence of a chronologically organized script, making the learning curve difficult due to the adoption of random topics or as new demands emerged (71%); (ii) the need to seek help from the designated mentor due to their unavailability (30%); (iii) the lack of any form of validation for the knowledge transmitted (100%).

4.4 Impact on newcomers' emotional states

The combination of the learning strategy, quality of support materials, and support and mentoring offered impacted the emotional state of newcomers during the onboarding period, causing negative and positive feelings.

In Figure 6, we see that the proportion of most feelings remained stable. Four of the feelings mentioned proved to be predominant since they obtained an average of the sum of their frequencies per period equal to 57%: worry, anxiety, frustration, and anguish. Other feelings that stood out were stress and sadness.

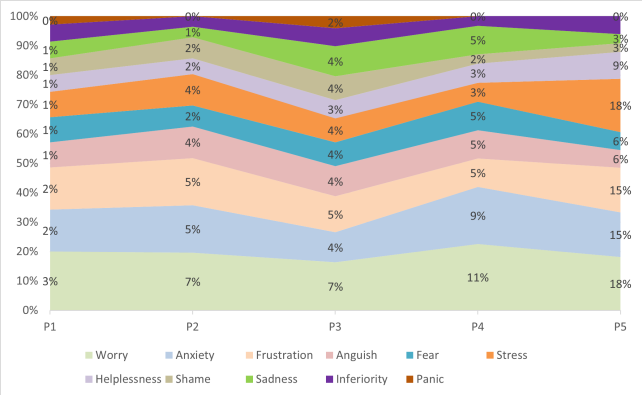

Figure 6: Negative feelings

When analyzing Figure 7, we also noticed that the proportion of most feelings remained stable. Four of the feelings mentioned proved to be predominant since they obtained an average sum of their frequencies per period equal to 54%: overcoming, gratitude, pride, and inspiration. Other feelings that stood out were hope and control.

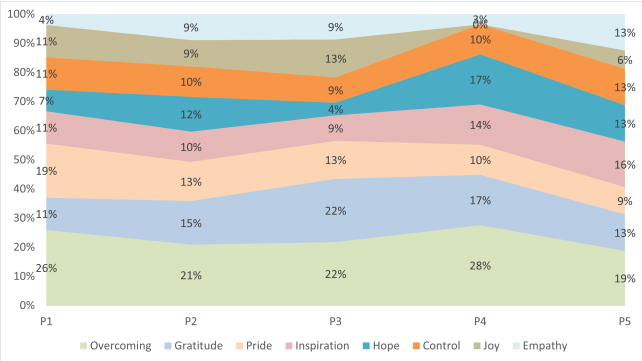

Figure 7: Positive feelings

At the finding review meeting, we presented this data and asked the audience to anonymously indicate which factors most triggered these feelings in a brainstorming format. As a result, we identified that the feelings of worry, anxiety, panic, and stress are associated with (i) the complexity of the software industry's production process, (ii) the lack of a learning script grouped by subject and ordered by dependence between subjects, level of difficulty and deadline, (iii) the application of the PBL approach using real projects. They suggested that part of the training be carried out with mocked-up or deactivated projects.

Feelings of frustration, anguish, sadness, and helplessness are associated with (i) periods of unavailability of people responsible for providing support or mentoring and (ii) low quality, superficiality, lack of completeness, or prolixity of some support materials. Feelings such as fear, shame, and inferiority can be associated with difficulties encountered in the learning process and performing activities at a different pace than other beginners.

Some participants reported that the environment was conducive to gradual learning, with adequate pressure, where making mistakes was not seen as something bad but as part of the learning journey, which generated feelings such as joy, empathy, and hope. While the feeling of overcoming, pride, and hope, control was associated with mastery experiences [2], which are successful experiences that strengthen the belief in one's ability to perform tasks, the feelings of gratitude, inspiration were associated with the existence of support materials, guidance, and mentoring, in addition to realizing that they were understanding, making decisions and generating results similar to their mentors.

Finally, it became clear that such feelings were not static or predominant but depended on the moment or phase of learning, combined with the learning strategy, the quality of support materials, and guidance or mentoring offered to newcomers during the onboarding period.

5 DISCUSSION

In this case study, we investigate the evolution of onboarding and project leader training processes in a global software development company over a decade. Our analysis revealed that the continuous integration of learning strategies, support materials, mentoring, and emotional state considerations is crucial to adapting the onboarding process to the software industry's ever-changing demands.

The importance of dynamic, personalized learning strategies has been consistently highlighted in our research. These strategies facilitate the acquisition of technical knowledge and skills needed to lead complex software projects and reinforce novice leaders' self-efficacy, aligning with Bandura's [2] observations about mastery experience and vicarious learning as fundamental factors for the development of self-efficacy.

Our findings show that learning strategies have evolved from informal approaches to structured and immersive onboarding. Initially, onboarding new employees occurred without formal training, consistent with the findings on the need for personalized onboarding strategies, claimed by Ju et al. [16]. Over time, Bauer [4] suggests that the complexity of the processes and the need to reduce ramp-up time led to the implementation of specific training and immersive sessions, aligning with recommendations on the importance of guidance, socialization, and clarity in onboarding.

The evolution of supporting resources, such as the internal wiki and training videos, has highlighted challenges related to maintaining and continually updating content. Meyer [20] emphasized the importance of perceived usefulness and organizational support for job satisfaction, and our results confirm that the quality and relevance of support materials are crucial. The literature also supports the need for organized and chronological resources, as seen in Britto et al. [8], which discuss the importance of clear learning structures. The transition to interactive digital resources and online learning platforms exemplifies adaptation to individual learning preferences and content availability.

Our findings highlight the variability in the definition and effectiveness of mentors over time. While most newcomers relied on

shared mentors, the lack of formal guidelines often undermined the quality of support offered. Fagerholm et al. [13] highlighted the critical role of mentoring in organizational socialization and the development of new employees, an aspect that our results reinforce. Personalization and consistency in mentoring are critical factors for building trust and self-efficacy among new project leaders.

The combination of learning strategies, support resources, and mentoring significantly impacted novices' emotional states. Feelings of worry, anxiety, and frustration were associated with the complexity of the production process and the lack of structured learning paths, as observed in previous studies on the emotional impact of onboarding [10]. Feelings of resilience, gratitude, and inspiration were associated with learning environments that promoted confidence and provided adequate emotional support.

As for the factors that influence the learning curve, our findings show that clarity and organization of learning content are essential. As suggested by Ju et al. [16], well-defined and accessible resources ease the learning curve. Positive personal experiences increase self-efficacy [2], so when content is clear and well-organized, novices are more likely to experience success, reinforcing their self-efficacy beliefs.

Adapting learning strategies to individual preferences has been identified as a critical factor. The need for personalization mentioned by Bauer and Erdogan [5] is reflected in our findings, where flexibility in training approaches was valued. Vicarious experiences, such as observing successful peers, also play an important role in self-efficacy. Adapting the pace of learning to allow for these observations can help novices develop a stronger belief in their abilities.

Practical experiences, such as practicing on real projects and applying problem-based learning (PBL), are essential for successful onboarding, as highlighted by Oran et al. [22] and Pham et al. [23]. These direct experiences are fundamental in building self-efficacy, as noted by Bandura [1], because when novices succeed in real tasks, their belief in their ability to perform their roles well increases.

The effectiveness of disseminating knowledge through mentors and support resources is also crucial. Studies such as Fagerholm et al. [13] emphasize the importance of mentoring and ongoing support, corroborated by our findings. Positive feedback and encouragement from mentors can boost newcomers' confidence in their abilities, which aligns with Bandura [1]'s concept of social persuasion. Additionally, maintaining a positive physiological state and minimizing stress and anxiety are vital for sustaining high self-efficacy during onboarding.

This case study contributes significantly to the existing literature, offering valuable insights into how organizations can design and implement informative and truly transformative onboarding and project leader training programs. Our results provide practical guidelines for implementing personalized learning strategies, continually improving support resources, and clearly defining mentor roles and expectations. Considering newcomers' emotional states and creating a positive learning environment can promote new employees' emotional well-being and productivity.

5.1 Recommendations to Improve Onboarding Effectiveness

The high turnover rate in the IT sector and continuous advancements in software development processes and technologies make the onboarding process of new team members both common and challenging. Understanding how critical factors such as learning strategies, support materials, guidance, and mentoring can contribute to creating a stimulating learning environment is crucial for the efficient development of skills and competencies, promoting emotional well-being, reinforcing self-efficacy, and increasing the productivity of newcomers. Addressing these aspects allows software companies to establish more effective integration strategies and action plans.

Based on the evidence and insights presented in this paper, we suggest several improvements to increase the effectiveness of the onboarding process in this context. Firstly, it is essential to continue investing in creating and constantly updating support materials, such as wikis, videos, and learning roadmaps, ensuring they are relevant and easily accessible. Short and focused materials can significantly enhance learning effectiveness by providing clear and concise information that is easier to assimilate.

In addition, structuring the mentoring process is paramount. Establishing formal guidelines and chronologically organized roadmaps for mentors ensures that all newcomers receive consistent and high-quality support. Clearly defining roles and expectations for mentors can facilitate this structuring, promoting a more robust and efficient support environment.

The adoption of personalized learning approaches is also critical. Adapting learning strategies to meet the individual preferences of newcomers allows for greater flexibility in the pace of learning and access to training resources. Applying the PBL approach using real low-complexity projects or inactivated projects can provide practical experiences that reinforce learning and increase newcomers' self-efficacy.

To support the newcomers' emotional well-being, creating a learning environment that minimizes stress and anxiety is necessary, promoting a space where making mistakes is seen as a natural part of the learning process. Positive feedback and emotional support during onboarding are key to achieving this goal.

Finally, reassessing and adjusting the workload of mentors and other team members is essential so they can adequately dedicate themselves to the mentoring process without compromising their daily activities. Balancing this workload to the needs of the onboarding process ensures mentors can offer quality support without being overwhelmed, benefiting both the mentors and the newcomers. These recommendations aim to create a more integrated and flexible onboarding process that efficiently develops skills and competencies while promoting emotional well-being and increasing the productivity of new employees.

5.2 Limitations and Threats to Validity

All studies have threats that can affect the validity of their results [35]. This study has several limitations. First, it was conducted in a single department of a global software development company, which may limit the generalizability of the findings to other companies or sectors. Additionally, the survey involved a limited number

of remaining participants, as many people who participated in the onboarding process were no longer part of the company, which may not fully represent the diversity of experiences within the department. Information collected through interviews and questionnaires is based on self-reports, which can introduce response biases such as selective memory or desire to please.

There are several threats to this study's validity. In terms of internal validity, there is selection bias, as participants were selected for convenience, which can introduce bias into the sample. Furthermore, the presence of researchers during the interviews may have influenced participants' responses despite efforts to minimize this influence. Regarding external validity, the ability to generalize findings to other settings and contexts may be limited, and exact replication of the study in other settings may be challenging due to contextual and organizational differences.

Regarding construct validity, the concepts of self-efficacy, learning strategies, and emotional states were operational based on theoretical definitions. Still, there may be variations in the interpretation and application of these concepts by participants. Data collection tools such as interviews and questionnaires were developed specifically for this study, and the lack of external validation of these tools may affect measurement accuracy. Regarding conclusion validity, this study is descriptive and exploratory, and conclusions about causal associations between variables should be interpreted with caution. Future studies with experimental or longitudinal designs may provide more robust evidence.

Recognizing these limitations and threats to validity is crucial to interpreting study results with appropriate skepticism and identifying areas for future research that can address these issues.

6 CONCLUSIONS

This paper presented how the onboarding and training processes for new employees in the project leaders department evolved over a decade by analyzing four aspects: learning strategies, learning support material, support and mentorship, and emotional impacts.

The results highlighted the importance of mentorship and support as essential tools for consolidating knowledge shared during training, self-study, and practical experiences using the problem-based learning approach. The study also revealed the challenges of creating and maintaining updated support resources in a dynamic and constantly evolving software production environment.

Effective management of these critical factors is believed to promote a learning environment that facilitates the development of skills and competencies more efficiently, promotes emotional well-being, reinforces self-efficacy, and increases the productivity of new employees. By recognizing the interdependence of these elements, organizations can develop more integrated and flexible training strategies, optimizing the development trajectory of newcomers.

The results of this study can be used by professionals to improve their onboarding processes, ensuring that new employees adjust and become productive more quickly, particularly in the software industry, which faces constant challenges of high turnover, rapid technological evolution, and the need for effective integration of new talent into cross-functional teams.

The results and insights identified by this study may serve as a starting point for other researchers. For future agendas, we suggest, in the software industry context, (i) conducting other case studies to compare and expand the findings and (ii) applying and validating the suggestions and improvement points in new onboarding processes, (iii) inspired by studies on developer experience, conducting empirical studies on onboarding experience.

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