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Social Gamification to Bond Sports Teams: The Effects of Cooperative and Cooperative-Competitive Designs

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Gamification is widely used in sports to enhance individual performance. In team sports, however, where social interaction and collective success matter, the use of game mechanics to encourage team interaction—known as social gamification—remains underexplored, despite its potential to foster collaboration and cohesion. This study examines how social gamification supports group dynamics, i.e., cohesion, social identity, and enjoyment in team sports, while addressing challenges like social loafing. Therefore, we developed a gamification app for soccer teams with two designs: First, a cooperative setting with team challenges and a virtual mascot; Second, a cooperative-competitive design adding a leaderboard for intra-team competition. These were tested in two four-week field experiments involving 119 participants. Results reveal that cooperative gamification fosters enjoyment, social identity, and aspects of cohesion, while intra-team competition does not harm group dynamics and actually promotes enjoyment. These findings highlight the effectiveness of social gamification and inform practical design strategies.

CCS Concepts: • **Human-centered computing** → **Field studies**; **Collaborative and social computing**; *User interface design*;

Additional Key Words and Phrases: Social gamification, sports, soccer, cooperation, group dynamics

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1 Introduction

Team sports have always been an integral part of human culture, serving as sources of entertainment, physical exercise, and social bonding. In contrast to individual sports, team sports are characterized by the association of athletes into teams that compete against each other and whose success depends not only on individual performance but also on the social dynamics within the teams [42]. Existing research highlights that the success of sports teams is driven by factors such as effective

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coordination, collaboration, or collective intentionality facilitated by group dynamics such as cohesion and social identity within the team and the sheer enjoyment of playing together [5].

While these fundamental principles remain unchanged, recent technological advancements are transforming the landscape of team sports. Motivational technologies, including gamified apps, are therefore becoming increasingly popular for enhancing the athletic experience, particularly at the amateur and recreational level [4, 74]. Gamification, defined as using game design elements and principles to enhance user engagement and motivation in any activity, system, service, product, or organizational structure [27], has emerged as a powerful strategy for engaging individuals in exercise. Gamification is commonly applied to enrich the amateur sports and training experience with additional opportunities for satisfying human needs, e.g., for perceiving competence and self-determination, and thus increasing motivation and shaping behavior [7, 9, 34, 44]. Existing research demonstrates that gamification can boost enjoyment and promote sustained engagement in different forms of exercise [28, 38, 44, 51, 55]. Moreover, users increasingly expect digital sports apps to incorporate gamified elements, reflecting their growing significance in the fitness landscape [80]. Beyond individual motivation, gamification can also act on a social level, integrating multiplayer elements to encourage and shape interaction, resulting in social gamification [82]. Social gamification approaches typically group users into teams and integrate game mechanics that encourage cooperative as well as competitive dynamics [26, 59, 69, 82].

In the context of sports, gamification is predominantly applied at the individual level, focusing on enhancing personal enjoyment and performance. However, team sports inherently emphasize social interactions and collective success, making it more appropriate to integrate designs that foster collaboration among team members [7, 9]. This presents a notable gap in research and practice regarding the application of social gamification in team sports. This gap is particularly surprising given that recent research highlights the effectiveness of social gamification approaches in enhancing collaboration and group dynamics within teams [68–70]. The question arises as to how social gamification should be designed to promote collaboration and group dynamics in amateur team sports and what outcomes such gamification interventions achieve.

On the one hand, cooperative gamification approaches have been shown to support teamwork and strengthen cooperative environments [59]. On the other hand, purely cooperative approaches can be susceptible to social loafing [82], where some team members contribute less effort due to shared responsibility. Research also suggests that engagement and participation in cooperative activities increase when competition is introduced, blending cooperation and competition [57]. However, the role of competitive features in fostering collaboration remains controversial. For instance, competitive ranking features, such as leaderboards, have been criticized for encouraging harmful intra-team competition, as individuals strive to outperform their teammates rather than work together [69].

In light of these considerations, social gamification has significant potential to enhance group dynamics, although its design and effectiveness in the sports context are complex. Social gamification can pose challenges to collaboration, potentially leading to negative effects such as social loafing, which can undermine positive dynamics. Therefore, this study aims at examining the research question of *how social gamification can foster key group dynamics within sports teams*, which are critical to success, namely cohesion and social identity, and enjoyment of the collaborative sports activity [5], while considering the potential downsides of social loafing [cf. 82]. We selected soccer as the context for conducting this research, given the global popularity of this team sport across all age groups, from children to adults [33]. Drawing on existing research, we first theoretically derived and implemented two social gamification approaches - one purely cooperative and the other cooperative-competitive - and then empirically evaluated their effects. Both gamification designs incorporate cooperative team challenges and a motivational virtual

mascot to foster collaboration and engagement. The cooperative-competitive approach further integrates a leaderboard as an additional design element to induce competition. Next, these designs were tested in two four-week field experiments with four soccer teams in Germany, primarily using quantitative methods. In the study with the cooperative-competitive design, we also collected qualitative data to gain additional insights into dynamics resulting from the interplay of cooperation and competition.

Taken together, the findings of this study provide empirical evidence on how social gamification influences group dynamics in amateur sports teams by applying group dynamics theory. The results indicate that cooperative social gamification can enhance enjoyment and foster a stronger social identity among team members, while its effects on team cohesion are more limited. Extending this design with competitive elements further enhanced enjoyment but did not yield additional gains in social identity or cohesion, nor did it affect social loafing. Based on these findings, we derive practical implications for designing context-sensitive social gamification systems that can facilitate the application of social gamification strategies in practice.

2 Theoretical Background

2.1 Social Gamification

Prior research in the domain of digital games has demonstrated that cooperative game design can foster beneficial social dynamics within groups, such as team identification, team commitment [46], team cohesion, and commitment toward shared goals, and ultimately improve team performance [41, 60]. Given such desirable outcomes observed in gaming, it is not surprising that recent years have seen an increasing interest in leveraging game design features and principles to engage people in cooperative behavior outside of gaming [68–70]. This development can be attributed to the practice known as *gamification*, which attempts to create positive “gameful” experiences by enriching non-game contexts with motivational design borrowed from game design [19, 27, 34, 44, 58]. A rapidly growing body of literature demonstrates that gamification is an effective intervention for positively affecting motivations and can even change behaviors in various contexts, including health and fitness [38, 55].

Previous research often frames these effects within a conceptual framework that distinguishes three core levels: the design elements of gamification, the psychological mediators or responses they elicit, and the resulting behavioral outcomes [29, 34, 56]. When it comes to the psychological responses of gamification, existing research has traditionally focused on the effects of specific design interventions on the motivational, affective or cognitive outcomes of individuals but has neglected to consider social dynamics [44, 45]. Consequently, there is growing interest in social gamification, which focuses the use of gamification to foster engagement and interaction within groups [68]. *Social gamification* employs game elements that encourage collaborative or competitive dynamics among users rather than focusing solely on individual achievement [82]. It is particularly pertinent in contexts where individuals are required to engage in collective action toward shared goals, such as in organizations or crowdsourcing environments, and a growing body of research provides evidence that such gamification can indeed promote collaborative behaviors and positively influence group dynamics [57, 68].

Existing conceptualizations divide social gamification into three types: cooperative gamification, competitive gamification, and cooperative-competitive gamification, which integrates elements of both collaboration and competition [59, 82]. Figure 1 illustrates these different types of social gamification on the left side. All of these forms are conceptually distinct from *individualistic design approaches*, where individual actions do not affect other users [47, 59].

Cooperative gamification, as a subset of social gamification, draws inspiration from cooperative game design and seeks to foster group-oriented outcomes such as collaboration, team identification,

and cohesion [41, 46]. Empirical studies substantiate the assumption that such cooperative gamification mechanisms can effectively strengthen group processes by fostering promotive interaction and sustaining cooperation among users [60, 68, 69]. Accordingly, the use of cooperative game design features such as team challenges, team progress, and team achievements in gamification approaches appears to be a promising approach for cultivating group dynamics in teams, as visualized in Figure 1.

However, some studies suggest that purely cooperative gamification may not universally lead to desirable outcomes. For instance, Zhang et al. [82] demonstrated that a pure cooperative gamification approach designed to foster team performance inadvertently led to lower engagement, thus yielding unintended and adverse effects. The research indicates that pure cooperative gamification approaches can promote social loafing behavior, a phenomenon in which individuals exert less effort when working in a group than when working alone. Further, research found that combining elements of cooperative and competitive gamification could overcome the limitation of a purely cooperative solution [57, 59]. When combining elements of cooperative and competitive gamification, individuals may benefit from the positive social dynamics of cooperative gamification, while the additional competitive elements could help to increase the visibility of individual contributions and thereby mitigate social loafing [82].

However, research emphasizes that designing competitions is complex and, as competitive gamification can take many forms, different design choices may lead to different outcomes [47, 71]. *Constructive* competition can enhance team dynamics by motivating individuals to challenge and support one another, fostering a sense of mutual growth and achievement. In contrast, *destructive* competition can emerge when participants experience feelings of exclusion or pressure, leading to disengagement and strained team relationships [71]. This dual nature of competition underscores the need for careful design of competitive gamification. In order to support teams, competitive mechanics should be designed to promote positive interactions, such as fostering mutual encouragement and shared success, while mitigating the risks of antagonism. When implemented effectively, competition can shift from a divisive force to a driver for cooperation and team bonding [71, 82]. Further, competition in games and gamification doesn't always require direct interaction or confrontation between users, such as in combat or dueling scenarios. As Liu et al. [47] point out, competition can also be facilitated through indirect game mechanics, such as leaderboards, achievement displays or performance rankings, which foster social comparison and motivating players through status and symbolic rewards without directly influencing others' performance. Nonetheless, ranking features, such as leaderboards, are often criticized due to their potential negative effects. Specifically in the context of leaderboards, research has demonstrated that they can induce a variety of undesirable consequences, including demotivation, reduced performance, and dislike [2]. It is therefore crucial to carefully design and balance cooperative and competitive features to encourage rather than discourage group dynamics, and to examine the user experience to ensure that it positively contributes to, rather than undermines, motivation and collaboration - an interplay conceptually illustrated in Figure 1.

2.2 Group Dynamics in Sports Teams

Sports teams share the basic characteristics of a *social group*, defined as “two or more individuals connected by and within social relationships” [23, p. 3]. What distinguishes teams, however, is their prerequisite: the pursuit of group goals, such as winning matches [23]. A group goal can be anything that a group of individuals wants to achieve. It is a goal or outcome that is important enough to motivate everyone in the group to work together to achieve it, rather than just the sum of individual goals [39]. This emphasis on achieving group goals, which in the sports context are often focused on

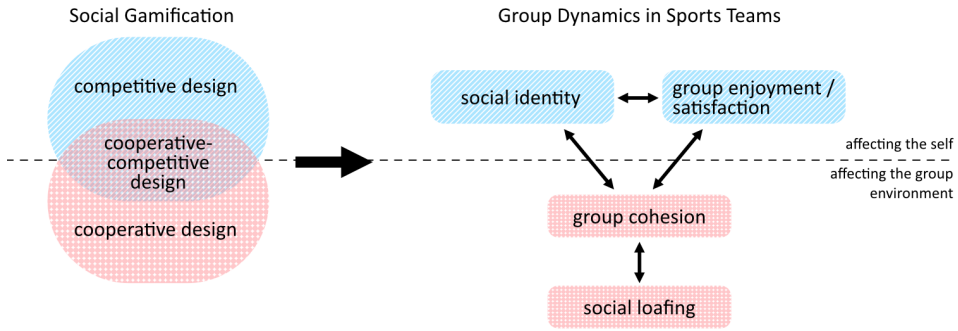


Fig. 1. Conceptual illustration of the interplay between social gamification (left) and group dynamics in team sports (right) under study.

improving performance or winning games, makes sports teams inherently performance-oriented groups. The performance and success of sports teams depends not only on the individual skills of the team members, but also on the strength of the interpersonal bonds between them, which are shaped by dynamic group processes [5]. Group dynamics, as an overarching concept, encompasses several dimensions, including dimensions affecting the self in the group and dimensions affecting the group environment. Prior research in the context of team sports has primarily centered on two central aspects of group dynamics: cohesion [14, 16, 63] and social identity [11, 63, 84], as outlined in more detail below.

Affecting the team environment, **group cohesion** plays an essential role in sports teams [14]. The concept of group cohesion describes the level of unity of a group [23, 24] and includes both task and social dimensions [5]. Task cohesion represents a general motivation toward the achievement of the group's goals, and social cohesion represents a general motivation toward the development and maintenance of social relationships within the group. Group cohesion - in the task and/or in the social aspects - is positively related not only to adherence in exercise settings, but also to performance and success in team sports [12, 14, 16, 25], thus considered to be a distinguishing attribute for success in sports [5], which leads us to make it the focus of our research as visualized in Figure 1. Therefore, creating and maintaining a high level of cohesion in sports teams is essential to practice.

While cohesion describes the bonding of team members at the group environment level, the concept of **social identity** shifts the focus toward the individual's self-concept within the group. Social identity refers to the extent to which individuals internalize their membership in a group as part of their self-concept [76]. This process fosters a collective perception of team members as *we* and *us* versus *them* [78]. Research shows that the strength of social identity within teams - such as in sports - often fluctuates depending on contextual factors like success or failure [63, 84], with higher identification typically observed during periods of winning and lower identification when losing. This suggests that social identity is closely linked with current satisfaction and enjoyment of a shared activity [62]. It is essential to promote identification with one's team, as team identification not only positively affects how athletes view their team [84], but also how they behave prosocially toward other team members [11], and the success and performance of their team [63]. Moreover, because social identity motivates team members to engage in social behavior, social identity can enhance cohesive behavior and has been found to be positively associated with higher cohesion [22]. On the other hand, high levels of group cohesion can foster a sense of belonging and commitment

among members [14, 16], which is crucial for maintaining social identity, reflecting a circular relationship between these factors. This interplay is illustrated in Figure 1 and highlights the complex relationship of different group dynamics.

The individual group members' **enjoyment** of physical activity **in their group**, resulting in satisfaction of participating, is an additional individual factor that has been found to affect team cohesion. While enjoyment can be seen as a subcomponent of cohesion [15], satisfaction and enjoyment of a group activity has also been investigated as a consequence of cohesive groups [23]. Notably, research underscores a circular relationship between cohesion and satisfaction. For instance, more cohesive teams tend to perform better, and high-performing teams experience greater enjoyment with their collaborative efforts. This increased satisfaction, in turn, contributes to increased levels of cohesion [54]. This circular relationship is also visualized in Figure 1.

However, groups are often prone to the phenomenon of **social loafing**, the tendency for individuals to exert less effort when working in a group than when working alone. The Collective Effort Model (CEM) [40] provides a widely accepted explanation for this behavior. According to the CEM, an individual's motivation to contribute to a group task depends on the perceived value and utility of their contribution to the group's success. Social loafing occurs when individuals perceive that their efforts are less likely to have a significant impact on valued outcomes in a collective context compared to working independently. Thus, social loafing is likely to occur when individual contributions are not easily identifiable, joint tasks lack personal relevance or value, a group outcome is perceived as less meaningful, or individuals believe that others will compensate for their reduced effort [40]. In team sports, social loafing may be affected by the established group cohesion. For instance, Høigaard et al. [31] found that higher group cohesion was negatively correlated with perceived social loafing in sports teams, indicating that cohesive teams experience less loafing behavior. Similarly, Zhu et al. [83] emphasized that perceptions of social loafing can influence group cohesiveness, suggesting that how members perceive their peers' contributions can shape their motivation and satisfaction within the group. This also indicates a bidirectional relationship between cohesion and social loafing as visualized in Figure 1.

2.3 Hypotheses

Based on the theoretical considerations outlined above, in particular, the notion that cooperative gamification can foster collaboration between users and has demonstrated potential to enhance group dynamics [57, 68], it is reasonable to assume that a cooperative gamification approach in the context of team sports is well-suited to strengthen team collaboration. In contrast, an individualistic approach, which focuses exclusively on individual user behavior and progress without social interaction or mutual dependency between users, does not explicitly target group processes. Cooperative gamification, by explicitly implementing social interaction between users, is therefore expected to have a particularly positive effect on group dynamics compared to an individualistic approach. Since group dynamics is a broad and multifaceted concept as described in Figure 1, we have focused on specific factors representing two key dimensions: (1) Individual-level factors within the group, encompassing social identity and group enjoyment. (2) Group-level environmental factors, with an emphasis on group cohesion, essential for team success. Accordingly, we formulate the following hypotheses:

- H1:** The use of cooperative social gamification in sports teams enhances group **cohesion** compared to a purely individualistic approach.
- H2:** The use of cooperative social gamification in sports teams enhances **social identity** compared to a purely individualistic approach.

H3: The use of cooperative social gamification in sports teams enhances overall **enjoyment** of team members' participation in the sports team compared to a purely individualistic approach.

While cooperative gamification offers many benefits, it also presents challenges, such as social loafing, which can hinder desired group dynamics [82]. In contrast, competitive gamification can increase individual motivation, but purely competitive settings have been associated with negative effects on group processes, including reduced cooperation and increased interpersonal tension [2, 71]. Prior research therefore suggests that integrating selected competitive elements into cooperative structures, such as leaderboards that encourage social comparison and indirect competition among team members, can help address the limitations of both approaches [57, 82]. In particular, such hybrid designs can enhance individual engagement and accountability, thereby mitigating social loafing while avoiding the detrimental effects of purely competitive environments. Thus, by promoting a balance between cooperative and competitive elements, it is anticipated that this combined cooperative-competitive approach can further improve collaboration and group dynamics within sports teams. Thus, we propose the following additional hypotheses:

H4: The use of cooperative-competitive social gamification reduces **social loafing** compared to purely cooperative gamification.

H5: The use of cooperative-competitive social gamification enhances group dynamics, including **cohesion and social identity**, and **enjoyment** of team sports, compared to purely cooperative gamification.

3 System Design

The present study follows a two-stage investigation, consisting of two field experiments. The first experimental study compares an individualistic solution with a purely cooperative approach to examine how cooperative social gamification strengthens group dynamics. The second experimental study addresses the potential limitation of a purely cooperative approach, i.e., social loafing, by exploring whether integrating elements inducing intra-team competition can further enhance group dynamics. Specifically, it compares the previously tested cooperative approach with a cooperative-competitive approach that includes additional competitive features. Both experimental studies employ a consistent gamification design, with minor modifications tailored to each study's specific focus, as illustrated in Figure 2. Importantly, each experimental condition takes an integrated design approach, rather than representing and investigating a single game design element, to capture realistic application scenarios of social gamification. This approach ensures that the interventions capture the intended social dynamics and potential impact of meaningful cooperative gamification. The following section details the design and its variations, including the foundational *individualistic system*, the *cooperative system* built upon it, and the *cooperative-competitive system*, which extends the cooperative model with competitive elements. A complementary video of the design can be found in the supplementary material. A detailed description of each experiment follows.

3.1 Individualistic System

We used a commercial product called adidas TEAM FX and extended it with custom-built gamification features [1]. The chosen product includes a performance tracking app specifically designed for soccer players, along with a sensor for tracking soccer-related performance data and specialized insoles for using the sensor in soccer shoes. The app provided a reliable means to track individual sports performance, making it an ideal foundation for integrating social gamification features based on performance in our experiments. Moreover, its original version served as the baseline individualistic system and control condition in the first experiment, allowing for a structured

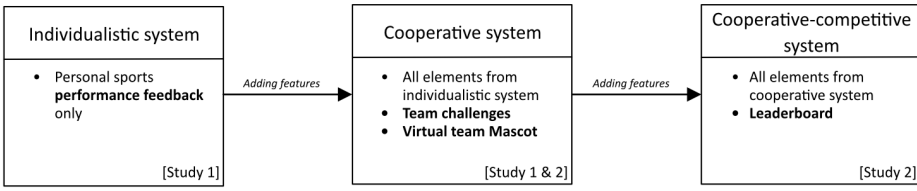


Fig. 2. System design overview.

comparison with the cooperative and cooperative-competitive approaches. The small performance sensor must be placed in the designated pocket within the insole of the user's dominant foot. When the sensor-equipped insoles are inserted into soccer shoes and worn during training or matches, the device accurately captures and records motion data: kicking speed, sprinting speed, distance covered, explosiveness bursts, and number of ball contacts. This allows the sensor to track various performance metrics, which can then be accessed via the synchronized app interface.

3.2 Cooperative System

For the intervention groups in our study, we implemented social gamification features in a new, separate tab of the app, thereby building on and extending the individualistic system. The purely cooperative version, introducing team challenges and a virtual mascot, is used by the intervention group in the first experiment and by one group in the second experiment. This purely cooperative concept has undergone a preliminary evaluation and shown positive results [6]. Each added feature is described in detail below.

Team Challenges: To foster collaboration and enhance group dynamics, we designed gamification features that reflect a core characteristic of sports teams: the pursuit of shared goals [23]. By incorporating challenging team goals into the app, we encouraged cooperative engagement, requiring players to work together to succeed. Research shows that challenging yet attainable goals enhance motivation and performance [49]. This is also true in game design, where goals that provide clear challenges and immediate feedback further boost engagement by fostering competence and achievement [34, 52, 53]. In cooperative games, shared goals have been shown to strengthen enjoyment, teamwork, and positive influence group dynamics [21, 60, 70]. To leverage these benefits, we introduced performance-based team challenges as system-driven shared goals within the gamification tab, aimed at reinforcing collaboration and thus cohesion, and enjoyment.

The challenges consisted of progressively more demanding running and ball-shooting tasks, carefully calibrated by the experimenter to align with each team's baseline performance capabilities. To achieve this, the experimenter first calculated the teams' average performance levels for running and ball-shooting skills based on baseline measurements conducted during the week prior to the intervention. Using these averages, the challenges were set to be achievable within 70% to 95% of the team's baseline performance. This approach ensured that the challenges were realistically attainable while still offering a meaningful level of difficulty to engage participants. The rationale behind this design was twofold: first, to allow the motivational effects of the gamification features to be realized by ensuring the goals were within reach; and second, to allow for potential fluctuations in training attendance or different focuses in the training sessions, as reduced player participation in certain sessions or a focus on tactical training in sessions may temporarily affect a team's overall performance in ways that we cannot predict or influence. By progressively increasing the difficulty of the challenges, we aimed at maintaining participant engagement and promote sustained effort across the intervention period without discouraging the teams. Over the four-week intervention period, each team was presented with five challenges (3 running and 2 ball-shooting

tasks), all visible in the app from the start of their use. However, each challenge was structured to be completed within a specific timeframe of one to two weeks, synchronized with the team's regular training schedule. As a result, completing a challenge typically required participation in two to four training sessions. To give an illustrative example, in one case, a team was challenged to collectively run a distance of 30 km in the first week ("Run 30 kilometers as a team"). This was followed by progressively more demanding challenges in subsequent weeks: 35 km in the second week and 40 km in the third. Similarly, ball-shooting challenges were typically structured within two-week intervals. In the first two weeks, teams were tasked with completing 1,000 passes ("Do 1,000 passes as a team"), and in the final two weeks, the challenge increased to 1,750 passes ("Do 1,750 passes as a team").

A screenshot of this feature is shown in Figure 3(a). Below the title and time constraints for each challenge, the app displayed individual contributions alongside a dynamic progress bar that visualized the team's overall progress. This feature provided instant feedback on the team's progress toward goal achievement. Upon successful completion of a challenge, the progress bar reached completion, and participants were greeted with a pop-up notification celebrating their accomplishment, as shown in Figure 3(c). To further support shared goals in a collaborative setting, adding features that deliver motivational rewards for achieving goals is recommended to reinforce the emotional responses linked to collaborative success [60]. Accordingly, each team member was rewarded with a badge prominently displayed next to the completed challenge.

Team mascot: To strengthen participants' sense of team identity, it is advantageous to include features that promote group affiliation [60]. Virtual goods, in particular, have proven effective in enhancing a user's social identity [32]. In the realm of sports, mascots hold a unique significance; they serve as a symbol of team branding and can help to cultivate social bonds that often span generations [75]. Further, research emphasizes that the removal of a long-standing mascot can even jeopardize social identity [75]. Drawing inspiration from this established tradition in sports teams, we incorporated a virtual mascot in our digital application to serve as a symbol and digital representation of the team's identity and to enhance team members' sense of belonging. The mascot was implemented as a 3D-rendered virtual character - a stylized ant - next to the team challenges in the app's gamification page, as shown in Figure 3(b). The ant was chosen because of its symbolic association with teamwork and social unity [50], making it an ideal representation for team-based sports.

The virtual mascot was designed not as a static visual element but as an interactive, lively character aimed at deepening user engagement. Based on successfully completed team challenges, accessories and new skills, i.e., animations, could be unlocked for the mascot as a joint reward by the team. These unlockables function as virtual goods, enhancing both the aesthetic and functional dimensions of the mascot and allowing personalization. The mascot is shown by default with a standing idle animation, giving it a lively and animated appearance. As participants unlock new skills, they can view the corresponding animations by clicking dedicated buttons associated with each unlocked ability. Additionally, when teams achieve specific challenges, the mascot automatically receives thematic accessories, such as a jersey or soccer shoes, showcasing the team's joint accomplishments visually.

3.3 Cooperative-Competitive System

In addition to these features, a second version includes a leaderboard for each challenge, referred to as the cooperative-competitive version, examined in the second experiment.

Leaderboard: As purely cooperative approaches in the sports domain have been shown to be prone to social loafing, which can negatively affect group dynamics, introducing a form of

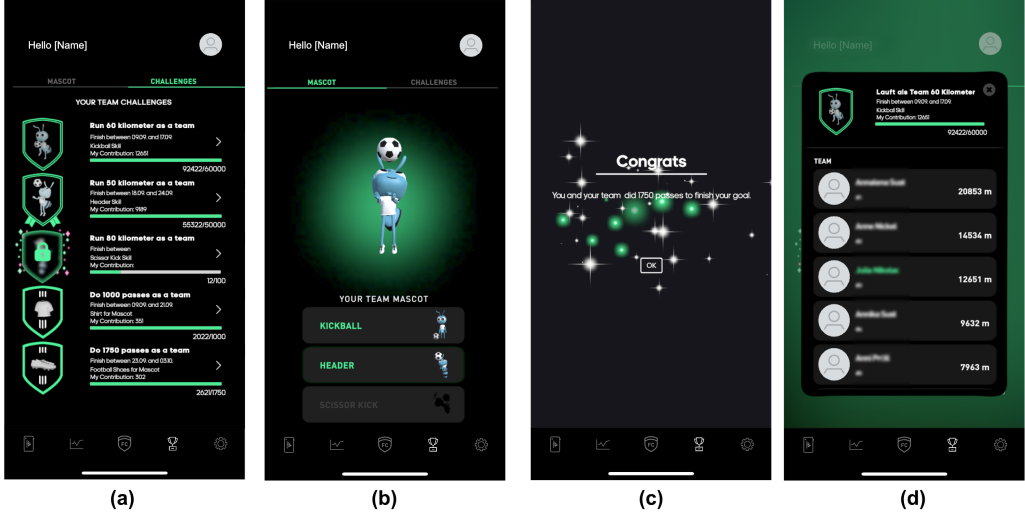


Fig. 3. Screenshots showcasing the gamification features developed for the two studies. (a) illustrates the challenge feature; In the cooperative-competitive version, users could click on each challenge to access the leaderboard feature and view individual contributions to the team’s progress (see (d)). In contrast, the purely cooperative version omitted this functionality, as no competitive elements, such as a leaderboard, were included by design. (b) depicts the mascot feature. (c) displays a popup celebrating goal achievement and unlocking of a new mascot skill/accessory. (d) shows the leaderboard feature, exclusive to the cooperative-competitive version of the app, which could be accessed by clicking on the corresponding challenge.

constructive competition presents a promising strategy to enhance a team’s experience and cohesion [71, 82]. Leaderboards are widely used competitive features that rank users - typically based on performance - allowing them to compare themselves with others [26]. While leaderboards are applied across various domains, preferences for their design and usage can differ significantly depending on the context. While leaderboards tend to be relatively unpopular in certain contexts, such as social networking, they are particularly well-received in the sport and fitness domain [37]. What makes their use in this context especially noteworthy is that, unlike in other settings where users often react negatively to low rankings, individuals in the sport and fitness context still report positive experiences and attitudes toward leaderboards, even when ranked at the bottom [35, 37]. This resilience in user perception makes leaderboards a particularly effective competitive feature in these environments. Thus, we added a leaderboard feature to increase the visibility of individual contributions, enhance members’ expectancy of their impact, and foster a sense of intra-team competition, thereby attributing greater value to team goals [40]. The leaderboard, as illustrated in Figure 3(d), was designed to be specific to each challenge and could be accessed by clicking on the corresponding challenge in the overview, indicated by a small arrow icon. Upon accessing a leaderboard, a popup window displayed the details of the associated challenge, followed by the leaderboard itself. The leaderboard ranked team members in descending order based on their contribution rates to the challenge as visualized in Figure 3(d), enabling direct comparison of individual efforts and fostering indirect competition [47]. To ensure that all contributors were visible, including those with lower contributions, the leaderboard supported scrolling, making all contributors visible. Each participant’s name was highlighted in green to allow for easy identification of their position within the ranking.

4 Study 1

In the first experimental study, we investigated how a purely cooperative social gamification approach strengthens group dynamics within sports teams by comparing its outcomes with a purely individualistic system, as described in Section 3. Thus, this study focused on answering H1 to H3.

4.1 Method

We conducted a pretest-posttest control group field experiment. The independent variable, the app version, was manipulated by providing the individualistic system as described in Section 3 to half of the participating teams, hereafter referred to as the control group. At the same time, the intervention group received the purely cooperative app version with the integrated cooperative features. To preserve the existing team dynamics within the longstanding teams - crucial for their success during the soccer season - we refrained from fragmenting the teams, opting instead to assign complete soccer teams to either the intervention or control group using a randomized assignment. The intervention took place over a four-week period. One week prior to the start of the experiment, baseline measures of the intervention group's performance were collected to facilitate the alignment of appropriate group challenges. During this preparation phase, the teams familiarized with the control group's version of the app, laying the groundwork for the subsequent experiment. They then transitioned to the gamified version for the scheduled four-week intervention period. Time of measurement was the second independent variable, meaning that all participants completed questionnaires both before and after the experimental phase. The survey included demographic data, measures of group dynamics and additional exploratory dimensions explained below, including goal commitment, goal attainment, and use of the features during the experiment. A list of the survey items used in the study is included in the Appendix Table 7.

4.2 Measures

As dependent variables, we considered the group dynamics cohesion and social identity, and enjoyment toward participation in the sports team, which were assessed in the pre- and post-surveys. We used McDonald's ω as a measure of scale reliability, as it addresses limitations of Cronbach's α , which assumes equal true score variance across items, a condition rarely met in psychological scales, often leading to underestimated internal consistency [20]. ω has been shown to outperform α across varying sample sizes and distributions, offering a more accurate estimate [20, 77]. Its interpretation is similar to α , with values below 0.7 typically indicating low reliability. In addition to the measures directly related to the hypotheses, we included further dimensions to measure potential influencing factors in one of the two surveys. This resulted in the following measures:

4.2.1 Demography. We covered a spectrum of demographic data. This included variables such as age, the length of time participants had been involved in soccer, when they joined their current team, and an exploration of their role as either a starter or substitute.

4.2.2 Cohesion. We assessed the cohesion using the Group Environment Questionnaire (GEQ) [13] in a German translation according to Wilhelm [79] and documented in Table 7. The GEQ contains 18 items covering four dimensions of cohesion:

- Attraction to Group - Social (ATG-S), assessing the personal desire to be a member of the team due to social interactions.
- Attraction to Group - Task (ATG-T), assessing the personal desire to be a member of the team due to tasks the group is doing.
- Group Integration - Social (GI-S), assessing the sense of closeness and bonding of the group as a whole.

— Group Integration - Task (GI-T), assessing the degree of unity of the group in achieving tasks.

For each dimension, the questionnaire contains four to five items that are answered on a Likert scale ranging from 1 (“strongly disagree”) to 9 (“strongly agree”). Single questions were reverse-coded so that higher scores indicated higher levels of cohesion. To analyze cohesion, a mean score is calculated for each subscale. In this study, the ω values for the four dimensions of the GEQ are 0.77 (pre) and 0.69 (post) for ATG-S, 0.61 (pre) and 0.67 (post) for ATG-T, 0.60 (pre) and 0.67 (post) for GI-S and 0.77 (pre) and 0.69 (post) for GI-T. Since ω is particularly small for ATG-T and GI-S with values close to 0.6, these scales need to be interpreted with the necessary caution. However, such values are commonly observed for this scale and are consistent with those reported in previous research [13].

4.2.3 Social Identity. The Four Item Measure of Social Identification (FISI) [66] according to [65] is used to assess the social identity of the team. The German version of the questionnaire was retrieved from Birnstiel [6] and is reported in Table 7. The scale consists of four items to be answered on a Likert scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). Higher scores indicate a higher level of social identity. To analyze social identity, a mean score of the items is calculated. McDonald’s ω for this scale was 0.82 (pre) and 0.83 (post).

4.2.4 Enjoyment. We assessed participants’ perceived enjoyment of the team activity, in this context playing soccer in their own soccer team, using the short version of the Physical Activity Enjoyment Scale (PACES-S) [17], as documented in Table 7. For a valid German translation, we used the corresponding items from the translated long version according to Jekauc et al. [36]. The questionnaire consists of four items to be answered on a Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). For the analysis, a mean score of the item is calculated. McDonald’s ω for this scale was 0.87 (pre) and 0.91 (post).

4.2.5 Goal Commitment. Commitment to the challenges set within the gamified version of the app is a fundamental prerequisite for the effectiveness of the social gamification design. It provides the necessary motivation for individuals to engage with the challenge feature [48] and, as such, serves as an important control variable in the experiment. To assess the commitment regarding the implemented challenges in the intervention group, we added the Goal Commitment Scale [43] to the post-survey of the intervention group. Since no German translation was available, the items were translated into German using the parallel translation method. Two independent persons, fluent in both English and German, translated the items. In cases where there were discrepancies between the translations, a discussion was held to determine the most appropriate wording. The questionnaire items and their translations are reported in Table 7. The questionnaire consists of five questions to be answered on a Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). For the analysis, a mean score of the item is calculated. McDonald’s ω for this scale was 0.70.

4.2.6 Goal Attainment. We measure the intervention group’s goal attainment, i.e., the number of goals achieved, for each team by accessing the application’s back-end system. This also allows us to track each team member’s contribution to the team’s goals, calculated as the percentage of team members who contributed to goal attainment.

4.2.7 Feature Usage. To assess the use of the cooperative gamification features implemented in the intervention group, we created a log system. This system records specific interactions within the gamification tab, i.e., the opening of the tab containing the gamification features, the mascot view being displayed, or the challenge view coming into focus. To analyze feature usage, we examine the frequency of events triggered.

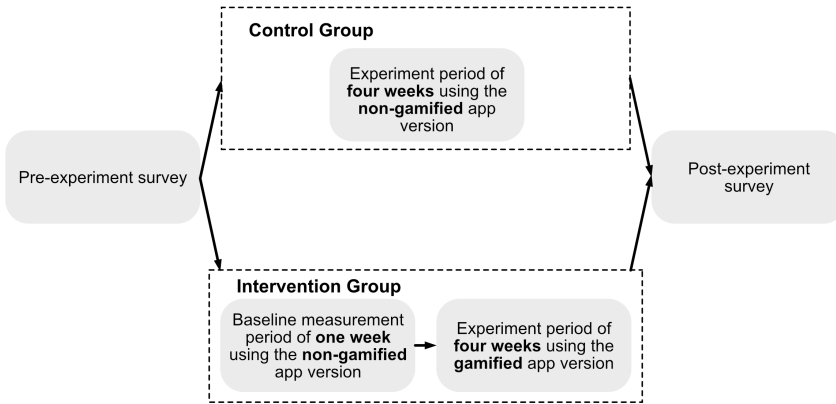


Fig. 4. The experimental procedure of study 1.

4.3 Procedure

The participating soccer teams were assigned to either the control or intervention group, with participants blind to their condition and unaware of the other available condition. Following this categorization, we distributed an informational document to the teams and organized pre-experiment meetings to obtain written consent, answer any questions, and facilitate the installation of hardware and software. After the meeting, we distributed a link to the initial survey, which participants completed individually in a distraction-free environment, such as at home. This survey included questions related to demographics, team cohesion, social identity, and enjoyment. Afterward, the experiment began for the control group. The intervention group required one additional week for baseline assessment of team performance in order to formulate appropriate challenges, as visualized in Figure 4. During this pre-experiment week, the intervention group used the control group's version of the app as a preparation phase. Then, the intervention group switched to the gamified version of the app. In a briefing session, they were introduced to the newly added gamification features and encouraged to familiarize themselves with them, which is comparable to a feature release notification in reality, explaining the newly added functionality. This ensured that they were aware of the features' availability and could engage with them during the experiment, thus ensuring that the experimental manipulation was delivered as intended.

During the four-week experimental period, both the control and intervention groups used their respective versions of the app in their training sessions, with the exception of actual matches. At the completion of the experimental phase, all participants received a second survey to complete individually. The survey again included questions related to team cohesion, social identity, and enjoyment. Only the intervention group was asked additional questions about goal commitment.

4.4 Participants

To ensure high external validity, we reached out to soccer coaches using contact information available on official club websites and invited their teams to participate in our research. Ultimately, 60 female amateur soccer players from four district league soccer teams participated in the experiment, with 31 players assigned to the intervention group and 29 to the control group. Two participants in the control group did not complete both surveys and were therefore excluded from the analysis, leaving 27 participants in the control condition.

The deliberate focus on female participants addresses a notable gap in existing research on female sports dynamics [3] as well as in studies examining the effects of gamification interventions in

Table 1. Demographic Statistics of Participants Divided into Control and Intervention Groups

Group	<i>n</i>	Age <i>M</i> (<i>SD</i>)	Soccer experience	Part of the current team	Status in matches
Intervention Group	31	25.1 (5.90)	<1 year: 0 % 2-3 years: 0 % >3 years: 100 %	<1 month: 0 % 1 - 6 months: 3.2 % 6 - 12 months: 9.7 % >12 months: 87.1 %	starter: 74.2% substitute: 25.8 %
Control Group	27	26.0 (4.45)	<1 year: 3.7 % 2-3 years: 3.7 % >3 years: 92.6 %	<1 month: 7.4 % 1 - 6 months: 3.7 % 6 - 12 months: 7.4 % >12 months: 81.5 %	starter: 88.9% substitute: 11.1%

soccer, which is often conducted with male-only samples [e.g., 64, 73, 81]. While we do not claim that such research is entirely absent, studies focusing on females with similar topics and designs are still underrepresented in this area. This particular focus is also motivated by the aim at ensuring homogeneity among the teams in terms of gender, skill level, and competitive environment, which are critical for maintaining consistency in the experimental conditions. Given the within-subjects design, this allowed us to observe changes in team-based interactions across conditions without introducing gender as a confounding factor, as the social dynamics under investigation are shaped more by team interaction than by gender itself. Table 1 provides an overview of the demographic information of the participants.

4.5 Results

We examined the impact of our two social gamification approaches on improving group dynamics in soccer using 2x2 mixed-design analyses of variance (ANOVA) and an alpha level of .05. The analyses were conducted in the statistics software jamovi as repeated-measures ANOVAs, with time (pre- vs. post-experiment) as the within-subjects factor and condition (intervention vs. control group) as the between-subjects factor for assessing the dependent variables cohesion, social identity, and enjoyment. We tested the assumptions for computing mixed ANOVAs for cohesion, social identity, and enjoyment. The data had no significant outliers, the normality assumption was met according to QQ-Plots, and sphericity was not a concern as the within-factor, time of measurement, was operationalized with only two levels. We tested the assumption of homogeneity of variances using Levene's tests. The results confirm the absence of violation of the assumption of homogeneity of variances. Descriptive data of the analyses is summarized in Table 2 and visualized in Figure 5.

4.5.1 Cohesion. We computed a mixed ANOVA for each of the dimensions of cohesion.

ATG-S: The analysis of the ATG-S dimension revealed a significant interaction between time of measurement and condition, ($F(1, 56) = 9.12, p = .004, \eta_p^2 = 0.14$). The two main effects were not significant, neither for the measurement time ($F(1, 56) = 3.33, p = .073, \eta_p^2 = 0.06$), nor the condition ($F(1, 56) = 0.41, p = .526, \eta_p^2 = 0.01$). Post-hoc tests using Bonferroni correction revealed only one significant pairwise comparison, in particular the difference between the pre- and post-measurements in the intervention group, ($t(56) = -3.55, p = .005$), indicating a significant increase in the ATG-S measurement during the experiment.

ATG-T: The analysis for ATG-T showed no significant interaction effect, ($F(1, 56) = 0.04, p = .846, \eta_p^2 = 0.00$). While the main effect of measurement time was not significant, ($F(1, 56) = 0.01, p = .931, \eta_p^2 = 0.00$), the main effect of condition revealed a significant effect, ($F(1, 56) = 4.55, p = .037, \eta_p^2 = 0.08$). Post-hoc with Bonferroni correction test indicated no significant result of the pairwise comparisons with $p > .405$.

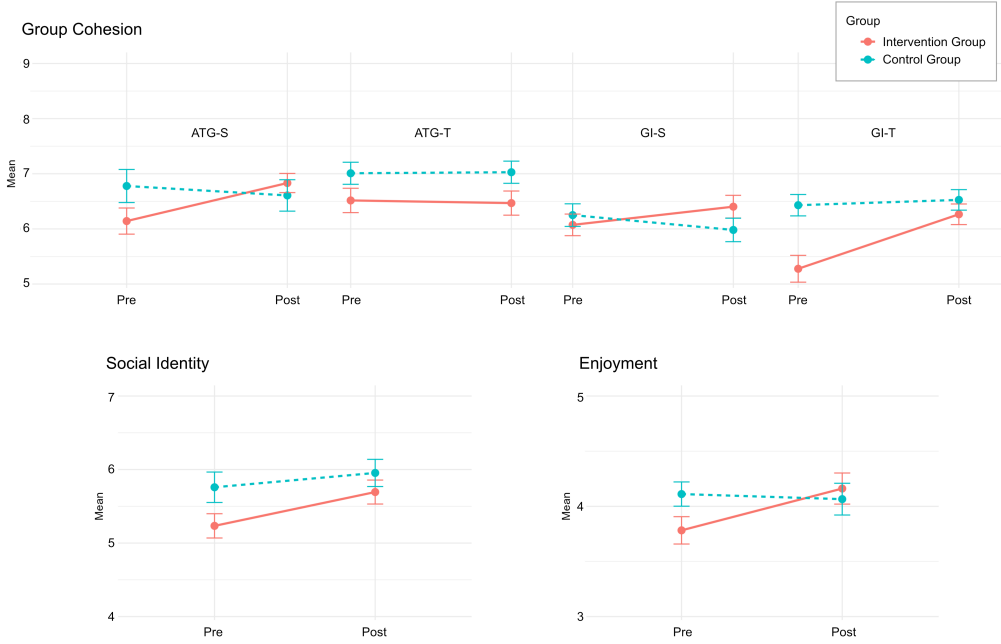


Fig. 5. Line plots of the group dynamics measurements. Error bars represent SE.

Table 2. Descriptive Data of Group Dynamic Measurements

Measurement		Intervention Group		Control Group	
		Pre	Post	Pre	Post
ATG-S	<i>M</i>	6.14	6.83	6.78	6.61
	<i>SD</i>	1.32	0.97	1.56	1.48
ATG-T	<i>M</i>	6.52	6.47	7.01	7.03
	<i>SD</i>	1.23	1.22	1.04	1.05
GI-S	<i>M</i>	6.07	6.40	6.25	5.98
	<i>SD</i>	1.09	1.15	1.07	1.11
GI-T	<i>M</i>	5.28	6.26	6.43	6.53
	<i>SD</i>	1.35	1.04	1.01	0.97
Social Identity	<i>M</i>	5.23	5.69	5.76	5.95
	<i>SD</i>	0.92	0.91	1.08	0.96
Enjoyment	<i>M</i>	3.78	4.16	4.11	4.06
	<i>SD</i>	0.69	0.79	0.57	0.75

GI-S: The analysis for GI-S revealed no significant effects for the interaction, ($F(1, 56) = 3.71, p = .059, \eta_p^2 = 0.06$), the main effects measurement time, ($F(1, 56) = 0.04, p = .842, \eta_p^2 = 0.00$), and condition, ($F(1, 56) = 0.25, p = .621, \eta_p^2 = 0.00$).

GI-T: The analysis of the dimension GI-T showed a significant interaction of the measurement time and the condition ($F(1, 56) = 11.61, p = .001, \eta_p^2 = 0.17$), and for both main effects of

measurement time, ($F(1, 56) = 17.18, p < .001, \eta_p^2 = 0.23$), and condition, ($F(1, 56) = 7.33, p = .009, \eta_p^2 = 0.12$). A post-hoc analysis with Bonferroni correction revealed a significant effect for the comparison of the pre-values of both conditions, ($t(56) = 3.64, p = .004$), indicating significantly higher pre-score for the control group. This indicates baseline differences between conditions, which should be considered when interpreting the interaction effect. The pre-values of the intervention group differed significantly from the same group's post values, ($t(56) = -5.53, p < .001$), indicating a significant increase in GI-T during the experiment for the intervention group. The comparison of the pre-scores of the intervention group also differed significantly from the post-scores of the control group ($t(56) = -4.30, p < .001$). The last result is reported for completeness but is not relevant to the study.

4.5.2 Social Identity. The ANOVA revealed no significant interaction of time of measurement and condition, ($F(1, 56) = 1.70, p = .198, \eta_p^2 = 0.03$). However, we found a significant main effect for time of measurement, ($F(1, 56) = 10.34, p = .002, \eta_p^2 = 0.16$). The main effect of the condition was not significant, ($F(1, 56) = 2.85, p = .097, \eta_p^2 = 0.05$).

Bonferroni corrected post-hoc tests revealed a significant effect for the comparison of the pre- and post-measurements in the intervention group, ($t(56) = -3.31, p = .010$). This indicates in particular a significant increase in social identity in the intervention group during the experiment. The comparison between the pre-measurements of the intervention group and the post-measurements of the control group also revealed a significant effect, ($t(56) = -2.84, p = .037$), which, however, was not relevant for the study. None of the other comparisons, including those of pre- and post-measurements of the control group, revealed any significant effects.

4.5.3 Enjoyment. The computed ANOVA revealed a significant interaction effect between measurement time and condition, ($F(1, 56) = 8.13, p = .006, \eta_p^2 = 0.13$). The main effect of time of measurement also showed a significant effect, ($F(1, 56) = 4.97, p = .030, \eta_p^2 = 0.08$), while the main effect of condition was not significant, ($F(1, 56) = 0.47, p = .498, \eta_p^2 = 0.01$).

Post-hoc testing with Bonferroni correction revealed only one significant effect, specifically for the pairwise comparison of the pre- and post-measurements in the intervention group, ($t(56) = -3.72, p = .003$), indicating a significant increase in enjoyment during the experiment for the intervention group.

4.5.4 Secondary Analysis.

Goal Commitment. The intervention group's goal commitment to the challenges presented in the gamified version of the app was reported as an average of 3.55 ($SD = 0.71$) on a five-point Likert scale. Thus, goal commitment was moderately high.

Goal Attainment. Among the challenges included in the gamified app, both teams in the intervention group successfully completed four out of five, as shown in Table 3. Two to eight team members actively contributed to each challenge, meaning these individuals generated performance data in training sessions and actively engaged with the solution to synchronize the data with the application to track progress on team challenges. In total, seven respectively eleven team members per team worked on the challenges, while the total number of participating team members in the experiment was 15 respectively 16. In total, 58% of the participants in the intervention group contributed to the challenges.

Feature Usage. The documentation in Figure 6 sheds light on how the intervention group engaged with the implemented cooperative gamification features. A closer look at both key features, i.e., team challenges and the virtual mascot, shows that the challenges were the main focus, receiving

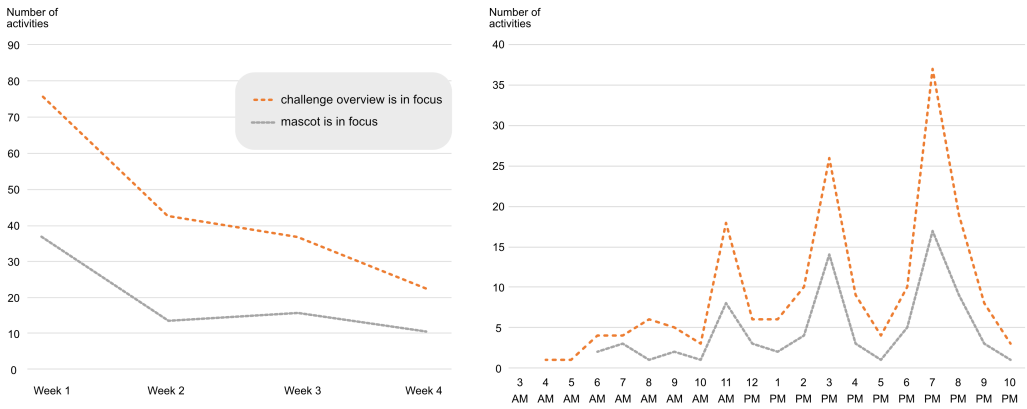


Fig. 6. Use of the cooperative gamification features implemented in the gamified version of the app over time.

Table 3. Goal Attainment of the Five Challenges Implemented in the Gamified Version of the App, Divided into Teams that are Part of the Intervention Group

Team	<i>n</i>	Run Challenge 1		Run Challenge 2		Run Challenge 3		Kick Challenge 1		Kick Challenge 2		Total
		Finished	<i>n</i>	Finished	<i>n</i>	Finished	<i>n</i>	Finished	<i>n</i>	Finished	<i>n</i>	
Team 1	16	Yes	6	No	7	Yes	2	Yes	8	Yes	6	11
Team 2	15	Yes	5	Yes	6	No	5	Yes	6	Yes	5	7
Total	31		35%		42%		23%		45%		35%	58%

more attention than the mascot, which was accessed about half as often. In addition, there was a noticeable decrease in feature usage over the four-week period. Regarding the temporal aspect, feature usage was not restricted to the evenings, specifically before, during, or after training. Notable peaks were also observed during the noon and afternoon hours, which are not typically associated with soccer training, indicating a high level of interest in the features beyond the training sessions.

5 Study 2

The first study examined the effects of a purely cooperative gamification approach compared to an individualistic system to assess whether social gamification can strengthen group dynamics in sports teams. While cooperative gamification led to improvements in certain outcomes, it did not result in a consistent strengthening across all investigated dimensions of group dynamics. These findings suggest that cooperative gamification alone may not be sufficient to support all group dynamics under study. Prior research has highlighted that cooperative gamification can be susceptible to drawbacks such as social loafing, which may limit its effectiveness in fostering sustained engagement and collective effort [82]. To counteract this limitation, theoretical and empirical work suggests that integrating elements of constructive, intra-team competition may increase individual engagement and accountability without undermining collaboration [57, 82]. Building on these insights and the findings of Study 1, the second study therefore focuses on extending the cooperative design.

Accordingly, Study 2 investigates whether augmenting a cooperative gamification system with competitive elements can reduce social loafing and enhance positive group dynamics further. Specifically, this study compares the effects of purely cooperative gamification with those of a cooperative-competitive gamification intervention. The latter introduces an additional leaderboard feature, as detailed in Section 3, to provide an indirect and constructive form of intra-team competition. With this setup, the study focused on investigating H4 and H5.

5.1 Method

Drawing on the results of the first experiment, we conducted a second field experiment with a slightly different setup. The independent variable, the app version, was manipulated by providing one group of teams with the purely cooperative gamified soccer app, while the other group received the cooperative-competitive version, which included an integrated leaderboard feature. Each group used their assigned app version for two weeks before switching to the other version, creating a crossover design where all teams experienced both versions sequentially.

To maintain the integrity of existing team dynamics, we again avoided fragmenting teams and instead assigned entire soccer teams to one of two intervention orders. This approach preserved the natural group interactions crucial for assessing the impact of gamification on group dynamics. Teams were assigned in a gender-balanced manner, ensuring that each condition included both male and female teams to enhance generalizability and better reflect the real-world diversity of team sports participation.

The total study spanned four weeks, with a one-week preparation phase prior to its start, in which the teams used the individualistic version of our app, used in study 1. During this phase, baseline performance measures were collected to appropriately align group challenges. Additionally, in this time, teams could familiarize themselves with the control version of the app (as described in Section 3) to establish a consistent starting point before transitioning to the gamified versions for the experimental period.

While participants experienced both app versions sequentially, carry-over effects may pose a potential confound in interpreting within-subject analyses. For instance, participants may have developed preferences or biases toward features in the first app version that could negatively influence their evaluation of the second version if a feature they liked was removed. To minimize such biases and enhance the validity of our results, we structured the analysis as a between-subjects comparison for hypothesis testing. A questionnaire was conducted after the first intervention phase to gather demographic data, measures of group dynamics, and exploratory variables. After completing both experimental periods, a second questionnaire focused on qualitative exploration. This final assessment aimed at capturing participants' overall experiences and reflections on the two gamified app versions, providing additional insights into dynamics resulting from the interplay of cooperation and competition.

5.2 Measures

As dependent variables, we again assessed the group dynamics factors of cohesion and social identity, and enjoyment of participation in the sports team, as described in the first study. In addition, social loafing was included as a dependent variable to address H2. Beyond measures directly related to the hypotheses, we incorporated additional items in the questionnaires to capture potential influencing factors. As in the first study, we collected demographic information, goal commitment, goal attainment, and feature usage. To gain deeper insights and address potential negative effects, such as dissatisfaction with the design, we incorporated exploratory open-ended questions. These questions were aimed at capturing participants' overall experiences and reflections on the two gamified app versions.

Most of the measures were identical to those used in the first study; for detailed descriptions of these, see Section 4.2. However, certain measures were specific to the second study, particularly those addressing social loafing and the qualitative exploration. These additional measures are described in detail in the following sections.

To assess the internal consistency of the scales used, we calculated McDonald's ω as a measure of scale reliability, with the results reported in Table 5. While most scales demonstrated acceptable reliability, a few - specifically ATGT, GIT, and Self-Loafing showed ω values below the commonly

recommended threshold of 0.7. However, such low values are not uncommon for these particular subscales of cohesion and have been reported in previous research [13], while previous research indicates slightly higher Self-Loafing rates (0.74) [31]. Nevertheless, due to the low inter-item correlations, the related findings should be interpreted with appropriate caution.

5.2.1 Social Loafing. To assess social loafing, we focused on two constructs: self-reported loafing and perceived loafing within the team. Self-reported loafing was measured using the four items from Høigaard et al. [30], while perceived loafing was assessed using the four items from Mulvey and Klein [61], as documented in Table 7. All items were rated on a 5-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”), while higher values indicate less social loafing. As no validated German translation of these items was available, we applied the method of parallel translation. Three independent individuals, fluent in both English and German, translated the items. In cases where discrepancies arose between translations, a discussion was held to determine the most appropriate phrasing.

5.2.2 Exploratory Questions. To capture participants’ individual experiences with each gamified version of the app, we included qualitative open-ended questions in the questionnaires. Specifically, after each usage period, participants were asked to share what they particularly liked and disliked about the version they had used in the current experimental phase. In the end, they answered these questions for each version (cooperative and cooperative-competitive version). In the final questionnaire, we included an additional question asking participants which version they preferred overall and to explain the reasons for their preference.

5.3 Procedure

The participating soccer teams were assigned to one of two intervention orders for the two gamified versions of the app. Participants were not informed of the specific design changes in advance; they were only told that the app’s design would change after the first two weeks of the experimental phase, with certain features varying between versions.

Before the experiment began, we distributed an informational document to all teams and conducted pre-experiment meetings as illustrated in Figure 7. During these meetings, we obtained written consent, addressed any questions, and facilitated the installation of both hardware and software. To ensure familiarity with the basic functionality of the sensor and app, all teams completed a one-week pre-experiment phase using the individualistic version of the app. This phase allowed for a baseline assessment of team performance, which was used to formulate appropriate challenges tailored to each team’s performance level. Following the baseline assessment, teams transitioned to one of the two gamified versions of the app: either the purely cooperative or the cooperative-competitive version. Teams received explicit instructions to actively engage with the gamification features during their training sessions.

The experimental phase lasted a total of four weeks. During this time, the teams used the gamified app exclusively during training sessions (excluding official matches). After two weeks of using the first version, participants were asked to complete the first, main questionnaire. The app design was then switched to the alternative version. After another two weeks of using the second version, participants completed a second questionnaire individually.

5.4 Participants

Similar to the first study, we contacted soccer coaches using publicly available contact information from official club websites and invited their teams to participate in the research. A total of 64 players from two women’s teams ($n = 31$) and two men’s teams ($n = 33$), all competing in regional amateur leagues, initially took part in the experiment. We ensured that each condition order was

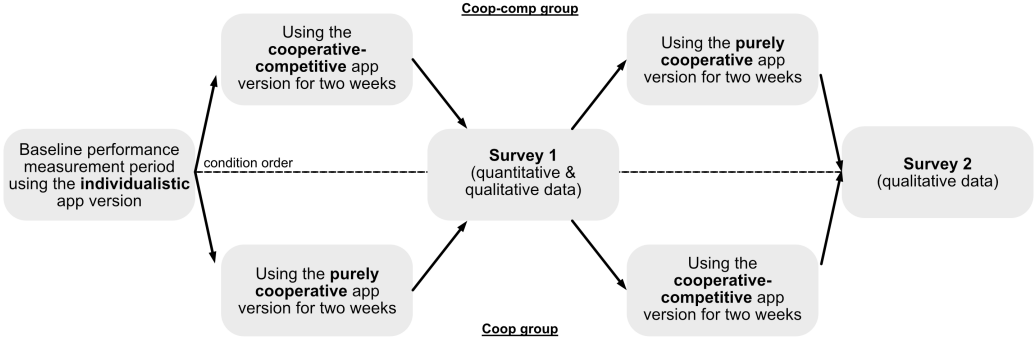


Fig. 7. Experimental procedure of Study 2 with two condition orders. Half of the teams followed the upper path, starting with the cooperative-competitive app and switching to the cooperative version after two weeks. The other half followed the lower path, beginning with the cooperative version before transitioning to the cooperative-competitive version.

Table 4. Demographic Statistics of Participants in Study 2 Divided by Starting Condition

Start condition	<i>n</i>	<i>n_{female}</i>	<i>n_{male}</i>	Age <i>M(SD)</i>	Regularity of being starter
Cooperative-competitive	32	16	16	23.03 (5.13)	always: 44% often: 28% rarely: 19% never: 9%
Cooperative	29	15	14	25.62 (4.65)	always: 41% often: 28% rarely: 28% never: 3%

completed by one women's and one men's team, while the actual assignment was randomized taking this rule into account. Accordingly, 30 players started with the purely cooperative version of the app, while 34 began with the cooperative-competitive version. Of the initial 64 participants, 61 completed the first questionnaire, and 60 completed the second questionnaire.

Table 4 provides an overview of the demographic information of the 61 participants who at least filled in the first questionnaire.

5.5 Results

To examine our hypotheses of whether the addition of competitive elements influenced group dynamics, we focused specifically on the first intervention period and, thus, the first survey, comparing the effects of each app version using independent sample Welch's *t*-tests and an alpha level of 0.05. The analyses were conducted in the statistics software jamovi. Additionally, we analyzed qualitative feedback collected at the end of each intervention period, captured in the first and second survey, focusing on participants' perceptions and experiences of the cooperative and competitive features tested.

5.5.1 Cooperative vs. Cooperative-Competitive Gamification. We assessed the assumptions required for independent-sample *t*-tests, specifically normality with the Shapiro-Wilk test and homogeneity of variances with Levene's test. Multiple measures did not meet the normality assumption,

Table 5. The Results of the Welch's Test Comparing the Cooperative (coop) and Cooperative-comparative (coop-comp) Versions of the App

	ω	Group	N	M	SD	Welch's t	df	p	d
ATGT	0.59	coop-comp	32	7.02	1.23	0.79	57.92	.435	0.20
		coop	29	6.80	0.97				
ATGS	0.77	coop-comp	32	7.14	1.31	3.11	57.46	.003*	0.80
		coop	29	6.06	1.40				
GIT	0.66	coop-comp	32	6.62	1.01	1.53	58.41	.130	0.39
		coop	29	6.22	1.01				
GIS	0.80	coop-comp	32	6.63	1.33	4.06	55.16	<.001*	1.03
		coop	29	5.46	0.91				
Social Identity	0.79	coop-comp	32	5.87	0.92	0.39	58.52	.698	0.10
		coop	29	5.78	0.91				
Enjoyment	0.94	coop-comp	32	3.95	0.88	2.05	57.96	.045*	0.53
		coop	29	3.47	0.91				
Self-Loafing	0.65	coop-comp	32	4.03	0.74	1.58	55.77	.120	0.41
		coop	29	3.71	0.85				
Perceived Loafing	0.80	coop-comp	32	4.05	0.73	1.41	58.32	.165	0.36
		coop	29	3.78	0.73				

and the two variables GIS and Commitment also failed the homogeneity of variances assumption. Given these violations and the general recommendation for the Welch's test, we chose to use Welch's test for all comparisons to ensure robust results [67, 72].

The results, summarized in Table 5, indicate significant differences for ATGS, GIS, and enjoyment. These measures were significantly higher for participants who used the cooperative-competitive version of the gamified app compared to those who used the purely cooperative version, suggesting that the competitive elements contributed to more positive experiences in the social cohesion factors and enjoyment of participating in the sports team. However, the task-related cohesion factors, ATG-T and GI-T, showed no significant differences. Similarly, no significant effects were found for social identity.

Social loafing was assessed using two constructs: self-loafing and perceived loafing. While both measures showed slightly more favorable descriptive values in the coop-comp group, these differences were not statistically significant. Moreover, the overall descriptive values suggest that social loafing occurred only to a minimal extent, with mean scores clustering around four on a five-point scale, indicating relatively low agreement with loafing-related statements.

5.5.2 Secondary Analysis.

Goal Commitment. Reported goal commitment to the in-app challenges averaged 3.89 ($SD = 0.92$) in the cooperative-competitive version of the app and 3.83 ($SD = 0.60$) in the purely cooperative version on a five-point Likert scale. Thus, goal commitment was moderately high in both versions and did not differ significantly between versions using Welch's t -test ($t(54.09) = 0.29$, $p = .772$, $d = 0.07$).

Goal Attainment. All participating teams successfully completed the two challenges set for the first two weeks of the experiment (Run Challenge 1 and Kick Challenge 1), as outlined in Table 6. The consistent completion of these initial challenges demonstrates the teams' engagement with the gamified app during the first intervention period.

Run Challenge 2, which extended across both intervention periods, began during the final training session of the first period and concluded after the first training session of the second period. This challenge was completed by four out of five teams. Run Challenge 3 and Kick Challenge 2 were set entirely within the second intervention period.

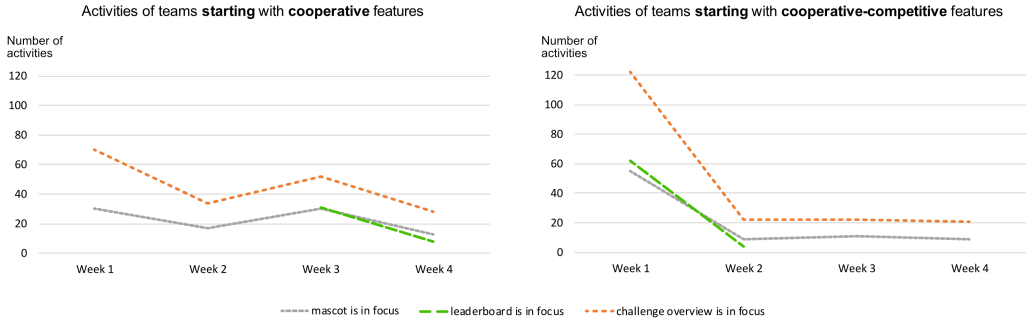


Fig. 8. Usage of the gamification features implemented in the gamified versions of the app over time, divided into the two condition orders.

Table 6. Goal Attainment in the Five Challenges Implemented in the Gamified Version of the App, Divided by Participating Teams

Team	<i>n</i>	Run Challenge 1 (1.-3. training)		Kick Challenge 1 (1.-4. training)		Run Challenge 2 (4.-5. training)		Kick Challenge 2 (5.-8. training)		Run Challenge 3 (6.-8. training)		Total <i>n</i>
		Finished	<i>n</i>	Finished	<i>n</i>	Finished	<i>n</i>	Finished	<i>n</i>	Finished	<i>n</i>	
Coop 1	15	Yes	10	Yes	10	Yes	7	Yes	8	No	8	11
Coop 2	15	Yes	9	Yes	8	Yes	7	No	9	No	6	10
Coop-comp 1	18	Yes	16	Yes	16	Yes	10	Yes	11	Yes	10	16
Coop-comp 2	16	Yes	10	Yes	10	No	5	No	6	No	6	11
Total	64		70%		69%		45%		53%		47%	75%

The abbreviation “Coop” stands for teams that started the intervention with the purely cooperative features within the app, while the teams with the abbreviation “Coop-comp” started with the cooperative-competitive version.

Overall, the contribution rate to the challenges was high, with 10 to 16 team members per team actively participating. This represents 75% of all participants contributing to at least one challenge, highlighting the general involvement of the teams in the gamified intervention.

Feature Usage. The participants’ engagement with individual app features is visualized in Figure 8, revealing a consistent descending pattern in usage frequency. Among the features, the challenge feature emerged as the primary point of interest, receiving the most attention from participants. Notably, the leaderboard feature, which was only available for two weeks, was accessed at a similar rate to the mascot feature, as illustrated in Figure 8.

Qualitative Results. Qualitative analysis of the responses to the exploratory open-ended questions provides a nuanced understanding of their experience during the experiment, complementing the quantitative data with valuable insights. An inductive thematic analysis approach following Braun and Clarke [10] was employed. Codes were derived directly from the data without a predefined coding framework. The coding was conducted by one author, who iteratively reviewed the responses, generated and refined codes, and organized them into broader themes through repeated engagement with the material. For this analysis, we decided not to exclude any particular response, regardless of whether people answered both questionnaires or all individual open questions, as answering these was optional and any feedback may be relevant.

In response to questions about what they particularly liked or disliked, participants provided detailed feedback on specific app features. Both app versions were praised for the **challenge feature**, which provided clear visualization of common goals and simple feedback mechanisms for tracking performance and progress. Users appreciated its role in maintaining engagement

and alignment with team objectives. However, some mentioned that the goals were too easy to achieve. The **mascot** feature, designed to reflect collective achievements through incremental improvements and unlockable skills, received positive feedback. Participants noted it as an engaging and motivating element of the app. However, several users suggested enhancing the relevance of unlockable skills by aligning them more closely with the sport context and increasing their variety. The **leaderboard** feature was identified as a central motivator for users favoring the coop-comp version. It was valued for promoting individual performance and fostering a sense of competition.

Of 55 responses, 46 (84%) expressed a preference for the cooperative-competitive version of the app, while 9 participants (16%) favored the purely cooperative version. Participants preferring the coop-comp version highlighted its ability to enable direct comparisons between individual team members. This comparative feature was frequently noted as fostering additional motivation and providing actionable insights for personal improvement. Participants appreciated the visibility of both individual contributions and collective team achievements, emphasizing the dual focus on self-improvement and team performance. Conversely, participants who preferred the purely cooperative version cited the avoidance of direct performance comparisons as a significant advantage. They noted that individual performance can be influenced by various factors, such as player roles and skill levels, making direct comparisons less meaningful or fair. For some, being listed on a leaderboard introduced feelings of exposure or discomfort, particularly when their performance was weaker. Others reported feeling demotivated when their teammates' lower performance placed an increased burden on stronger players. The cooperative version mitigated these concerns, fostering a more inclusive and harmonious team environment focused on individual self-improvement. The purely cooperative version was recognized for its pragmatic advantages, including a clearer focus and enhanced usability. Participants appreciated its simplicity and the emphasis on fostering social interaction. Notably, the cooperative structure encouraged players to voluntarily share performance insights, leading to organic discussions and exchanges about strategies and experiences.

6 Discussion

This study investigated how social gamification can enhance group dynamics and enjoyment in team sports, using amateur soccer teams as context. Through two field experiments, we examined how cooperative and cooperative-competitive designs influence key group dynamics, i.e., group cohesion and social identity, and overall enjoyment in team sports, and examined the challenge of social loafing. Our findings contribute to the growing body of knowledge in gamification by extending the perspective beyond individual motivation to group-level processes and dynamics, and advance our understanding of the psychological outcomes of social gamification designs.

6.1 Enhancing Group Dynamics Through Social Gamification

The field experiments demonstrated that social gamification can positively influence individual-level group dynamics, particularly enjoyment in participating in the sports team, and show promising effects on social identity under cooperative conditions.

For instance, both studies consistently showed that social gamification contributes to increased enjoyment in team sports. Specifically, the cooperative design significantly boosted participants' enjoyment of team sports throughout the intervention (supporting H3), while the cooperative-competitive version elicited even greater enjoyment levels. These findings suggest that integrating social gamification can enrich the affective experience of team sports likely due to heightened interaction and shared goals, while the addition of intra-team competition may further amplify enjoyment of team sports, potentially by increasing the visibility and comparability of individual contributions [57].

Social identity also improved significantly under the cooperative condition and not so under the control condition. While overall differences between conditions were small, this within-condition improvement exclusively in the intervention group highlights the potential of cooperative gamification to strengthen social identity in team settings. This indicates that shared objectives and collective rewards, such as equipping a shared virtual mascot, may foster a stronger sense of group affiliation and help individuals feel more connected to their team (supporting H2) [60]. However, no significant difference was found between the cooperative and cooperative-competitive designs in terms of social identity. This suggests that while cooperation strengthens team identity, introducing intra-team competition does not further enhance social identity (rejecting H5).

Effects on group cohesion, however, were more nuanced. Across both experiments, specific aspects of cohesion revealed significant changes, while others remained unaffected. Therefore, cooperative gamification showed limited influence, suggesting it may not be sufficient to foster overall team cohesion (rejecting H1). Adding intra-team competition appeared to strengthen the social dimensions of cohesion (ATG-S and GI-S), but also did not universally strengthen cohesion across all dimensions (rejecting H5). Instead, the results suggest that the effectiveness of gamification depends on its specific design, with different configurations influencing distinct aspects of team cohesion.

6.2 Social Loafing

Since purely cooperative designs can be susceptible to social loafing, a phenomenon where individuals contribute less in group settings, social loafing may partly explain why not all dimensions of group cohesion improved in the first experiment [31, 82]. Therefore, a central motivation for the second study was to explore whether the integration of competition could mitigate social loafing by increasing individual accountability. This, in turn, was expected to further strengthen group cohesion, social identity, and enjoyment of participating in team sports. To address this, the second experiment implemented a cooperative-competitive design, which embedded a leaderboard within the otherwise cooperative design. This hybrid approach was intended to foster constructive intra-team comparisons and increase accountability through increased evaluative potential [71, 82].

However, the competitive leaderboard did not lead to a significant reduction in either self-reported or perceived social loafing, suggesting that the addition of intra-team competition alone is insufficient to significantly reduce social loafing (rejecting H4). However, social loafing only emerged at a minimal level across both conditions, aligning with previous research which indicates that team sports environments are generally less prone to social loafing [18]. These findings suggest that within cooperative social gamification interventions for team sports, social loafing may not be a critical concern. Moreover, the observed improvements in certain aspects of cohesion in the cooperative-competitive version appear to stem not from a reduction in loafing, but rather from the motivational influence of competition on social dynamics.

6.3 The Roles of Cooperation and Competition

Overall, the findings highlight the potential of social gamification, particularly when grounded in cooperative mechanics such as shared goals and group-based rewards, to foster stronger relational bonds within teams. Specifically, the cooperative design contributed to a heightened sense of team identity, increased enjoyment, and improvements in specific aspects of group cohesion. These results are in line with prior research emphasizing the value of gamified cooperation in enhancing shared experiences, interpersonal connection, and group identification [60, 68].

The cooperative-competitive condition further amplified participant's enjoyment of participating in the sports team and was generally preferred. Qualitative feedback revealed that many participants found the leaderboard motivating, appreciated the balance between individual accountability

and collective achievement. Several participants noted that the feature encouraged more active participation in team challenges without undermining the cooperative spirit.

Thus, although the hypotheses related to the cooperative-competitive condition could not be statistically confirmed, the design still led to significantly increased enjoyment and, importantly, no adverse effects on group dynamics were observed. While a small number of participants reported feelings of discomfort or demotivation due to the leaderboard, consistent with prior concerns on the use of competition for gamification [2], the majority experienced it as a constructively motivating feature. This aligns with theoretical perspectives such as the theory of constructive competition [71] and the CEM [40], which suggest that competition can enhance motivation when embedded in a supportive, team-oriented context.

Taken together, these findings suggest that carefully balanced competitive elements, when embedded within a predominantly cooperative structure, can enhance engagement and individual accountability without undermining social identity and cohesion. Although the cooperative-competitive design did not lead to consistent improvements across all investigated dimensions, it represents a promising approach for team-based gamification interventions.

6.4 Theoretical Contributions

This research advances our understanding of gamification by investigating how cooperative and intra-team competitive gamification can promote group dynamics in teams, respectively sports teams, thereby making an important contribution to the field of social gamification. While much of the existing literature has explored the affective and cognitive potentials of gamification through the lens of individual psychological theories, such as Self-Determination Theory, Flow Theory, or Motivational Affordance Theory [45, 69], our study focuses the barely researched field of social gamification through drawing on theories of group cohesion, social identity, and the CEM.

By grounding our analysis in group dynamics theory [5], we highlight how gamified systems can shape not only individual engagement but also interpersonal relationships and group functioning. Our findings show that social gamification elements, particularly shared goals and collective achievements, can significantly enhance self-related group constructs, such as social identity and team enjoyment. However, effects on team-level constructs, such as cohesion, were more nuanced and appeared contingent.

Crucially, our work contributes to a more nuanced understanding of competition in gamification. While competitive elements such as leaderboards have been criticized for potentially undermining motivation, social experiences or creating social pressure [2], our cooperative-competitive design showed no negative effects on group dynamics. Instead, participants reported that the leaderboard increased motivation and accountability without compromising cooperation. This supports the notion of constructive competition, where well-calibrated competitive elements can complement cooperative structures by encouraging personal contribution within a collective framework [40, 71].

These findings underscore the importance of context-sensitive gamification design. Rather than viewing cooperation and competition as oppositional, our findings suggest that a balanced integration can create synergistic effects - promoting both engagement and team dynamics - when appropriately aligned with the context. As such, this study contributes to a growing understanding of gamification as a holistic social system rather than a set of standalone motivational elements.

6.5 Engagement Patterns and Feature Use

Usage data across both studies revealed a typical novelty effect: engagement peaked during the first week and gradually declined thereafter, a pattern commonly observed in gamified systems [29]. This pattern suggests that the initial engagement was driven by curiosity and a desire to explore the new features introduced in the study briefing, rather than by sustainable motivational mechanisms.

As interaction with several features decreased over time, the findings indicate that novelty alone was insufficient to maintain long-term engagement. Despite this decline, participants continued to interact with core features throughout the intervention, indicating sustained, albeit reduced, overall interest. Notably, the team challenge feature consistently received the highest engagement, significantly exceeding interaction with the virtual mascot. This suggests that features directly supporting goal tracking and collective progress may be perceived as more meaningful and therefore more resilient to novelty decay than symbolic or representational rewards [8]. In the cooperative-competitive condition, the leaderboard was accessed as frequently as the mascot, highlighting its role as an additional meaningful motivational trigger when embedded within a cooperative context. Taken together, these findings underscore the importance of designing gamified systems with mechanisms that extend beyond initial novelty by emphasizing meaningful, task-relevant features. Additional strategies to counter engagement decay may include pacing the introduction of features, periodically refreshing challenges, or introducing adaptive goals that evolve with team progress. Such approaches may not only sustain perceived meaningfulness over time but also reintroduce novelty to stimulate renewed curiosity and encourage continued interaction in the longer term. Interestingly, engagement was not confined to training sessions. Despite the absence of push notifications or reminders, participants accessed the app during off-peak hours, particularly around lunchtime and in the afternoon, pointing to an intrinsic interest in the gamified experience.

Early team challenges were consistently completed across teams, while completion rates declined for later, more difficult tasks. This trend corresponds with only moderate levels of goal commitment, a known predictor of goal attainment that reflects participants' motivation to persist [48]. A likely contributing factor was that only about half of the participants consistently used the tracking sensors required to contribute to challenge progress, suggesting that technical effort and habit formation may play a role in long-term engagement. Despite this, most intervention teams successfully completed the majority of challenges, suggesting that well-calibrated and attainable goals, a cornerstone of effective goal setting [49], can sustain motivation in a social gamification design even as novelty fades.

At the same time, usage data indicate that not all participants engaged with every team challenge. Importantly, the gamification design did not require uniform participation for effects to emerge at the team level. The system operated through shared outcomes: completed challenges, unlocked badges, and mascot features were visible to all team members, regardless of individual contribution. Consequently, even less active participants were exposed to collective progress and could benefit from shared achievements. This shared visibility and collective reward structure likely reinforced a sense of joint accomplishment and group identity, highlighting the importance of outcome sharing rather than individual task completion for the effectiveness of social gamification in team settings. Accordingly, the observed effects should be interpreted as arising from the overall cooperative gamification environment rather than from engagement with specific challenges alone.

6.6 Practical Implications for Gamification Design

This research offers several design-oriented implications for designers and developers looking to implement cooperative gamification in team-based sporting environments. These implications are derived from the observed effects of the studied overall gamification designs and should be interpreted as guidance rather than as a direct result of using individual elements of the integrated design.

- P1** Shared team challenges can serve as powerful motivational anchors in cooperative gamification designs, especially when progress and outcomes are visible to all team members. While the present study does not experimentally vary goal difficulty, the findings suggest that

carefully calibrating the difficulty of challenges is important for maintaining engagement, whereas overly difficult challenges can lead to disengagement.

- P2** Virtual mascots, although not the primary source of engagement in our design, may meaningfully support team identity and emotional involvement when embedded in a cooperative system and linked to collective achievements and milestone celebrations.
- P3** While often met with skepticism in social contexts, leaderboards may foster personal accountability and engagement when thoughtfully embedded within a cooperative structure. Thus, rather than functioning as stand-alone competitive mechanisms, their effects appear to depend on how they are embedded within a broader cooperative context.
- P4** Making team progress and achievements visible to all members, including less active participants, seems important. Ensuring that everyone benefits from collective success may strengthen group identity and reduce the risk of disengagement or exclusion.

6.7 Limitations and Future Research

While this study provides valuable insights into social gamification in team-based settings, several limitations offer opportunities for further investigation.

First, both studies were conducted exclusively with amateur soccer teams. Although soccer was chosen for its global relevance and representative features, such as collaboration, coordination, and shared goals, team dynamics can differ across sports due to variations in team size, individual roles, or performance visibility. For example, smaller teams or sports with more specialized roles may experience different responses to cooperative or competitive gamification. Future research should examine the transferability of our findings to other team sports, such as basketball, volleyball, or handball, and explore how contextual factors, such as gender composition, skill and experience level, or cultural background, influence the effectiveness of social gamification designs.

Second, in many team sports, player roles are dynamic and emergent (e.g., starters vs. substitutes, leadership roles, or position-specific responsibilities), which may influence how individuals perceive and engage with gamified features. For instance, players with less playing time or less visible in-game contributions may experience team challenges and collective rewards differently than core players. While the present study focused on team-level outcomes in training sessions, treating teams as a homogeneous group, future research should examine how role differentiation and in-play shifts in matches affect individual perceptions, engagement, and the perceived fairness of social gamification systems.

Third, the first study focused on female teams, which allowed for a consistent investigation of the evolution of group dynamics within this context but may limit the generalizability of the findings. Differences in motivation, competitiveness, or responses to aesthetic features may influence how gamification elements are perceived and engaged with. While the second study incorporated mixed samples, examining gender-specific effects was beyond the scope of this research. Therefore, future studies should explicitly compare the effects on teams with different gender compositions to better understand how social gamification designs function in diverse contexts.

Fourth, the study evaluated holistic gamification designs rather than isolating the effects of individual features. While this allowed us to assess the overall impact of complete systems (e.g., cooperative vs. cooperative-competitive designs), it limited our ability to pinpoint which specific features, such as team challenges or virtual mascots, contributed most to the observed outcomes. Future research should adopt modular experimental designs to isolate and test the influence of individual gamification elements and their interactions.

A fifth limitation relates to the temporal discrepancy between conditions in the first study. The intervention group underwent an additional baseline week to allow for challenge customization, compared to the control group. While this introduced a slight difference in exposure duration

between groups, the intervention group still showed large improvements in group dynamics, whereas the control group remained stable or slightly declined in some measures (e.g., ATG-S, enjoyment). Given these trends, we do not expect the extra week to have meaningfully influenced outcomes. Nonetheless, this temporal mismatch may have introduced potential confounds and warrants attention in future research.

Sixth, beyond social loafing, the study found few indications of further individual-level negative effects of social gamification. A small number of participants reported feeling uncomfortable or demotivated by the leaderboard, which aligns with previous concerns about competition in gamified systems [2]. However, these effects were only captured through open-ended responses and were not systematically examined. Thus, the underlying mechanisms and long-term implications of such negative experiences remain unclear. Future research should explicitly investigate further individual-level unintended effects of social gamification in team sports using targeted measures and approaches.

Finally, future research should explore longer-term engagement and retention in gamified team environments. While we observed a decline in engagement after the first week, which is a common pattern in gamified systems, the motivational sustainability of cooperative-competitive designs remains an open question. Investigating how feature novelty, challenge pacing, or adaptive personalization of challenges or the virtual mascot can counteract the decline in engagement would provide valuable insights into the long-term viability of gamification in social settings.

7 Conclusion

This research investigated how social gamification designs can foster group dynamics within sports teams. Across two field experiments with amateur soccer teams, we examined the effects of cooperative and cooperative-competitive gamification approaches on individual- and group-level outcomes, focusing on social identity, enjoyment, team cohesion, and social loafing. Social gamification led to significant increases in enjoyment and social identity over time, whereas consistent effects on group cohesion could not be established. The cooperative-competitive approach was introduced to address potential drawbacks of purely cooperative systems, such as social loafing. While this approach did not yield additional improvements in social identity, cohesion, or reductions in social loafing compared to the cooperative condition, it did further strengthen enjoyment. Overall, these findings suggest that cooperative social gamification is the primary driver for fostering social bonds, while competitive elements may play a complementary role by supporting individual engagement. Taken together, this work contributes to gamification and sports research by grounding the investigation in group dynamics theory and providing field-based evidence that social gamification designs can positively influence individual-level group dynamics in real-world team sport environments. The findings underscore the importance of context-sensitive gamification design. Rather than viewing cooperation and competition as oppositional, the results suggest that their careful integration may create synergistic effects. In this sense, the study supports a view of gamification as a holistic social system rather than a collection of standalone motivational elements. Future research should build on these findings by examining longer-term interventions, isolating specific design elements in modular experimental designs, and exploring how factors such as player roles, gender composition, and sport-specific contexts moderate both the positive and negative effects of social gamification.

Ethics Statement

The study was approved by the Institutional Review Board of the German Association for Experimental Economic Research e.V.. Participants provided written informed consent prior to their involvement, and their anonymity and confidentiality were assured throughout the research process. Participation was entirely voluntary.

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Appendix

Table 7. This Table Presents the Questionnaire Items Utilized in this Study. Each German Item is Accompanied by its Original English Version to Ensure International Comprehensibility

Construct	Item	German	English original	Source
Cohesion	ATGS1	Ich nehme gerne an den gesellschaftlichen Aktivitäten dieser Gruppe teil.	I do not enjoy being part of social activities of this team. (R)	Carron et al. [13], Wilhelm [79]
	ATGS2	Ich werde die Mitglieder der Gruppe vermissen, wenn die Saison vorbei ist.	I'm not going to miss the members of this team when the season ends. (R)	
	ATGS3	Einige meiner besten Freunde sind in dieser Gruppe.	Some of my best friends are on this team.	
	ATGS4	Ich mag andere Ausflüge lieber als Ausflüge mit der Mannschaft. (R)	I enjoy other parties rather than team parties. (R)	
	ATGS5	Für mich ist diese Gruppe eine der wichtigsten sozialen Gruppen, denen ich angehöre.	For me, this team is one of the most important social groups to which I belong.	
	ATGT1	Ich bin zufrieden mit der Spielzeit, die ich bekomme.	I'm not happy with the amount of playing time I get. (R)	
	ATGT2	Ich bin zufrieden damit, wie intensiv sich mein Team darum bemüht, ein Fußballspiel zu gewinnen.	I'm unhappy with my team's level of desire to win. (R)	
	ATGT3	Diese Gruppe gibt mir genügend Möglichkeiten, meine persönliche Leistung zu verbessern.	This team does not give me enough opportunities to improve my personal performance. (R)	
	ATGT4	Mir gefällt, wie die Gruppe organisiert ist.	I do not like the style of play on this team. (R)	
	GIT1	Unsere Gruppe versucht gemeinsam, unsere Leistungsziele zu erreichen.	Our team is united in trying to reach its goals for performance.	
	GIT2	Wir übernehmen alle Verantwortung für schlechte Leistungen unserer Gruppe.	We all take responsibility for any loss or poor performance by our team.	
	GIT3	Unsere Gruppenmitglieder haben gegensätzliche Ansprüche an die Gruppenleistung. (R)	Our team members have conflicting aspirations for the team's performance. (R)	
	GIT4	Wenn Mitglieder unserer Gruppe Probleme haben, würde jeder helfen, damit wir erfolgreich sein können	If members of our team have problems in practice, everyone wants to help them so we can get back together again.	
	GIT5	Unsere Gruppenmitglieder tauschen sich frei über ihre jeweiligen Verantwortlichkeiten aus.	Our team members do not communicate freely about each athlete's responsibilities during competition or practice. (R)	

(Continued)

Table 7. Continued

Construct	Item	German	English original	Source
	GIS1	Mitglieder unserer Gruppe würden lieber alleine ausgehen als sich mit der Gruppe zu treffen. (R)	Members of our team would rather go out on their own than get together as a team. (R)	
	GIS2	Die Mitglieder unserer Gruppe feiern selten zusammen. (R)	Our team members rarely party together. (R)	
	GIS3	Unsere Gruppe würde gern außerhalb des Trainings/ Spiels Zeit miteinander verbringen.	Our team would like to spend time together in the off season.	
	GIS4	Die Mitglieder unserer Gruppe sind auch viel zusammen wenn wir kein Training oder Spiel haben.	Members of our team do not stick together outside of practice and games. (R)	
Social identity	SI1	Ich identifiziere mich mit meiner Fußballmannschaft.	I identify with my soccer team.	Birnstiel [6], Postmes et al. [65]
	SI2	Ich fühle mich in dem, was meine Fußballmannschaft betrifft, involviert.	I feel committed to my soccer team.	
	SI3	Ich bin froh, dass ich eine Spielerin in meiner Fußballmannschaft bin.	I am glad to be a player in my soccer team.	
	SI4	In meiner Mannschaft zu sein ist ein wichtiger Teil dessen, wie ich mich selbst sehe.	Being part of my soccer team is an important part of how I see myself.	
Enjoyment		Das Fußballspielen und die Trainings mit der Mannschaft während der letzten zwei Wochen ...	Playing soccer and training with the team over the last two weeks ...	Chen et al. [17], Jekauc et al. [36]
	E1	machten mir Freude.	I enjoyed it.	
	E2	genoss ich.	I found it pleasurable.	
	E3	waren sehr angenehm.	It was very pleasant.	
	E4	fühlten sich gut an.	It felt good.	
Goal commitment	C1	Es war schwer, die Teamziele ernst zu nehmen. (R)	It's hard to take the team goals seriously. (R)	Klein et al. [43]
	C2	Mir war es egal, ob wir die Teamziele erreichen oder nicht. (R)	Quite frankly, I didn't care if we achieved the team goals or not. (R)	
	C3	Ich fühlte mich stark dazu verpflichtet, bei dem Erreichen der Ziele beizutragen.	I was strongly committed to pursuing the goals.	
	C4	Es hätte nicht viel gebraucht, mich dazu zu bringen, keinen Beitrag zu den Teamzielen zu leisten. (R)	It wouldn't have taken much to make me abandon the team goals. (R)	
	C5	Ich glaubte, dass es sich lohnt, die Ziele zu erreichen.	I thought these are good goals to shoot for.	

(Continued)

Table 7. Continued

Construct	Item	German	English original	Source
Social Loafing	SL1	Ich bemühe mich so sehr ich kann.	I try as hard as I can.	Høigaard et al. [30]
	SL2	Ich leiste meinen Anteil nicht. (R)	I do not do my share. (R)	
	SL3	Ich trage weniger bei, als ich sollte. (R)	I contribute less than I should. (R)	
	SL4	Unter Berücksichtigung meiner Fähigkeiten gebe ich mein Bestes.	Given my abilities, I do the best I can.	
	PL1	Mitglieder meiner Gruppe bemühen sich so sehr sie können. (R)	Members of my group are trying as hard as they can. (R)	Mulvey and Klein [61]
	PL2	Mitglieder meiner Gruppe sind 'Trittbrettfahrer'.	Members of my group are "free-loaders."	
	PL3	Mitglieder meiner Gruppe tragen weniger bei, als ich erwartet habe.	Members of my group are contributing less than I anticipated.	
	PL4	Unter Berücksichtigung ihrer Fähigkeiten geben die Mitglieder meiner Gruppe ihr Bestes. (R)	Given their abilities, my group members are doing the best they can. (R)	

Items Marked with an "R" were Reverse-coded Prior to Analysis

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