

## ORIGINAL ARTICLE

# An experiment on the impact of coaches' and athlete leaders' competence support on athletes' motivation and performance

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**Purpose:** Grounded in the Cognitive Evaluation Theory, the present experiment aimed to compare the relative impact of competence support provided by coaches versus athlete leaders on players' competence satisfaction, intrinsic motivation, and performance.

**Methods:** We recruited 18 existing competitive male basketball teams (ie, 126 players) to participate in the experiment. Each team was randomly assigned to one of three conditions: (a) the coach provided competence support (ie, by encouraging, providing positive feedback, and expressing team confidence); (b) the athlete leader provided competence support; or (c) neither the coach, nor the athlete leader provided competence support (ie, control condition).

**Results:** Teams in which the athlete leader provided competence support reported higher levels of competence satisfaction and intrinsic motivation than teams in the control condition, a difference that did not emerge when the coach provided competence support. Furthermore, teams in which either the coach or the athlete leader supported team members' competence performed better compared to teams in the control group.

**Conclusion:** Our findings highlight the importance of providing competence support to enhance team performance. Given athlete leaders' unique impact on teammates' competence satisfaction and motivation, instructing athlete leaders how to provide competence support constitutes an important motivational pathway for coaches to optimize team functioning.

## KEY WORDS

competence satisfaction, peer leaders, self-determination theory, shared leadership, team captain, team performance

## 1 | INTRODUCTION

Motivation is one of the driving forces underlying athletes' effort expenditure and dedication to their sport.<sup>1,2</sup> Athlete motivation can be nurtured by a wide variety of factors, including the true enjoyment and challenge of an activity but also more external rewards such as money, contingent regard from

others, and media attention. Self-Determination Theory<sup>3-5</sup> presents different forms of motivation on a continuum of increasing self-determination, with intrinsic motivation representing the hallmark of volitional or autonomous functioning. Given that intrinsically motivated people truly enjoy engaging in their sport, they absorb the information more rapidly and, as a result, make more progress and perform better.<sup>6</sup> In

addition, previous research highlighted the role of intrinsic motivation as a buffer against feelings of fear, depressive symptoms, and ultimately dropout.<sup>7-13</sup>

Given the role of motivation as driver of performance and buffer against dropout, the promotion of intrinsic motivation is especially valuable in a competitive sport setting, where the stakes are high and the external pressure often piles. Coaches, but also players and in particular the team leaders, can act as an important sources to nurture team members' intrinsic motivation<sup>14</sup>. The present experimental study will therefore investigate the relative importance of both coaches and athlete leaders in competitive sports teams.

### 1.1 | Nurturing intrinsic motivation: the cognitive evaluation theory

Cognitive Evaluation Theory (CET), a sub-theory of SDT highlights that athletes' intrinsic motivation, can be nurtured and maintained if their inherent need to feel competent in dealing with the environment (ie, their need for competence) gets fulfilled.<sup>15</sup> That is, as far as athletes feel capable of mastering the required activities and have the feeling that they can exercise and extend their skills, they are more likely to perceive the activity at hand to be inherently satisfying and interesting and they will also perform better.<sup>16,17</sup> To foster athletes' intrinsic motivation, coaches are thus advised to support their need for competence, for example by setting optimal challenges, creating a predictable and well-structured environment through clear guidelines and expectations at the start, or by offering guidance and feedback during task execution.<sup>18-20</sup>

This study focuses on one of these competence-supportive behaviors, namely the provision of positive feedback. The reason for this focus is that sport activities are replete with instances of both implicit and explicit feedback. That is, feedback is often implicitly present in activity execution such that athletes observe automatically whether they can complete an activity successfully (eg, scoring or missing a free throw). On the other hand, feedback can also be provided by external sources such as the coach or teammates. Previous research across different sports (eg, softball, tennis, basketball, football, etc.) investigated the effects of competence-supportive feedback. Specifically, in competitive sports, positive encouragement and praise by coaches and teammates were positively related to athletes' competence satisfaction<sup>21</sup>, intrinsic motivation<sup>22,23</sup>, and performance.<sup>14,24</sup> Research in motor skill learning further corroborated these findings. For instance, Lewthwaite and Wulf<sup>25</sup> demonstrated that feedback emphasizing successful performances and positive normative feedback (ie, information about how you outperform others) affected learners' motivation. This increased motivation in turn facilitated the learning of motor skills, thereby contributing to performance progress (for a review, see Wulf et al<sup>26</sup>).

Feedback has thus not only a motivational impact, but these motivational benefits also carry over to athletes' motor learning and performance.<sup>26,27</sup> In this study, we will focus on the impact of explicitly communicated positive feedback by comparing the impact of two common external sources of feedback in sports teams, namely the coach and the leader within the team.

### 1.2 | The motivating role of coaches and athlete leaders

Although the topic of competence support by the coach has been studied intensively, the majority of these studies were correlational in nature.<sup>22,28</sup> To our knowledge, only two experimental studies have been performed on whether and how coach competence support affects athletes. Both experiments showed that competence support in the form of positive feedback by the coach positively affected athletes' competence satisfaction, intrinsic motivation, and perceived performance.<sup>23,24</sup> It should be noted, although, that both studies manipulated the provided feedback via an external experimenter instead of relying on athletes' own coach as a source of feedback.

Besides the coach also athletes within the team can take up leadership roles (ie, athlete leaders) and become an important source of competence support.<sup>29,30</sup> Previous research indeed showed that athlete leaders who provide positive feedback to their teammates have a beneficial impact on various outcomes, including teammates' team confidence, the team's cohesion, athletes' identification with their team<sup>31-33</sup>, the team's resilience when facing setbacks,<sup>34</sup> and ultimately also the team's performance.<sup>30,35</sup>

Although studies evidenced the impact of competence support by both coaches and players, none of these studies directly contrasted these two external sources of feedback. As such, their relative impact on the team is largely unknown. However, as Fransen et al<sup>36</sup> observed, leaders who occupy a central field position have the potential to be better leaders. As athlete leaders can lead their team from the playing field, their central position compared to the coach on the sideline potentially results in a larger impact on their teammates. On the other hand, sports teams are usually structured hierarchically, placing the coach above the players. This heightened status of coaches, in combination with the fact that they make most tactical decisions (eg, who plays during competitive games) might help explain why the feedback of coaches has a stronger impact on the team compared to the feedback of athlete leaders.

This study aimed to investigate the motivational impact of both coaches and athlete leaders, thereby studying their relative strength. This study is part of a systematic research program of experimental studies by Fransen et al<sup>14,24,37</sup> on the motivating role of athlete leaders. These experimental

studies vary in terms of the operationalization of competence support (eg, positive feedback, confidence, encouragement), the number of included conditions, the inclusion of confederates or the actual leaders in the team to provide competence support, the type of task used (ie, individual vs. team task), as well as the type of sport (ie, soccer vs. basketball).

Specifically, in a first study,<sup>37</sup> teams of five basketball players were asked to perform a team task (ie, taking free throws). A research confederate, introduced as the team captain, displayed either high or low team confidence. When the confederate expressed high team confidence, his teammates reported greater feelings of team competence, and also performed better (ie, they scored more). In a subsequent study, Fransen et al<sup>14</sup> demonstrated that these findings could be generalized to an interactive passing task in soccer, with the motivational benefits of a highly confident athlete leader also emerging in relation to a control group instead of merely a low confidence group.

To further increase the ecological validity, Fransen et al<sup>24</sup> made use of existing teams (instead of assembling players unfamiliar to each other) and asked the actual athlete leader in the team (ie, the player being perceived as best leader by his teammates) instead of a research confederate to provide positive feedback. The findings revealed that, compared with a control group, the provision of motivating feedback by either the coach or the athlete leader promoted athletes' competence satisfaction, which, in turn, enhanced their intrinsic motivation and subjective performance satisfaction. Interestingly, competence support also produced greater quantitative performance benefits (as reflected by the increased speed at which the task was executed) without a loss in qualitative performance (as reflected by the scoring percentage). This improved objective performance could not be accounted for by a change in either competence satisfaction or intrinsic motivation. Instead, this improvement represented an immediate benefit from the provided competence support.

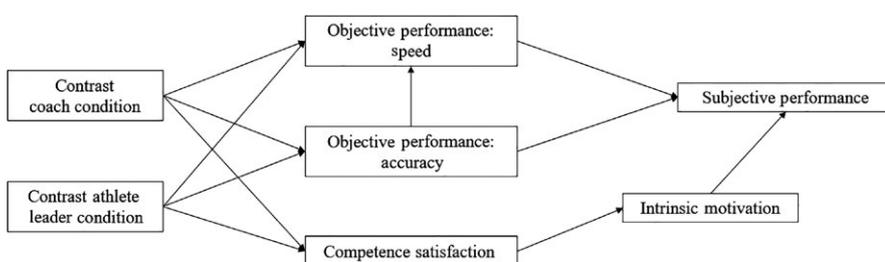
However, whereas athlete leaders were the actual leaders of the participating teams and were briefly instructed by a research confederate on how to provide competence support, the coach was a research confederate who was introduced to the team as the coach for the upcoming task. In other words, the ecological validity of the competence support by the "coach" can be questioned.

### 1.3 | The present research

The aim of this study was to experimentally contrast the impact of competence support provided by the actual coaches and athlete leaders of existing sport teams. In contrast to previous research,<sup>24</sup> we will no longer use a research confederate as coach. Instead we will instruct the actual coach of the team how to provide motivating feedback. This change increases the ecological validity of the experiment and allows verifying whether the previous results that were obtained with research confederates also hold for the actual coaches. In addition, given that both the coach and the athlete leader receive the same information and instructions on how to provide competence support in this study, we will be able to directly compare their impact.

Building upon previous research<sup>16,17,24,38</sup> and relying on the framework of CET,<sup>4,5</sup> we assume that the provision of positive feedback—whether provided by the coach or the athlete leader—will increase athletes' competence satisfaction, which, in turn, will facilitate athletes' intrinsic motivation and their subjective task performance. Besides this motivational pathway involving a chain of motivational processes leading to improved performance, we also examined the possibility of a direct performance pathway. In line with earlier experiments of Fransen et al<sup>24</sup>, we expect that the provided positive feedback by either the coach or the athlete leader may yield an immediate increase in objective performance. That is, the conveyed feedback may prompt extra effort among the athletes such that they execute the task more quickly (reflecting an improvement in quantitative task performance) and more accurately (reflecting an improvement in qualitative task performance). This increased objective performance will in turn influence participants' perceptions of performance, assessed after the test session. Both pathways are visualized in Figure 1.

Based on theorizing grounded in CET<sup>4</sup> and on previous research,<sup>14,23,24</sup> the following hypotheses can be formulated. Compared with the control condition, competence support provided by both the coach (Hypothesis 1) and the athlete leader (Hypothesis 2) is expected to increase athletes' competence satisfaction (H1a, H2a) and intrinsic motivation (H1b, H2b), as well as their subjective (H1c, H2c) and objective performance (H1d, H2d). Given the lack of research evidence on the relative impact of coaches and athlete leaders and given that, as



**FIGURE 1** Structural model, representing the expected mediating pathways of the influence of competence support on participants' objective performance and competence satisfaction as described in hypothesis 3

indicated above, arguments can be made for both directions of the equation, we did not postulate an a priori hypothesis with respect to their relative impact.

With respect to the underpinning mechanisms, we expect to find, in line with the work of Fransen et al<sup>24</sup>, two mediating pathways in the prediction of intrinsic motivation and performance, as visualized in Figure 1 (Hypothesis 3). The first pathway is that players' competence satisfaction will mediate the relationship between leaders' competence support and players' intrinsic motivation, which in turn will affect their feelings of subjective performance (H3a). Besides this motivational pathway, we also expect a direct performance benefit such that the experimentally provided competence support will directly influence players' objective performance, which then will feed into players' subjective performance perceptions (H3b).

## 2 | METHODS

### 2.1 | Procedure

We contacted 24 Flemish basketball clubs (with male teams active in U16 and U18 age categories) of which nine decided to participate in the experiment, resulting in a response rate of 37.5%. Ethical consent was obtained in a first questionnaire a few weeks before the experiment. Players participated voluntarily and were guaranteed full confidentiality. Furthermore, the ethical committee of the first author's university approved the study design. After completion of the experiment, we debriefed the participants about the actual aims and conclusions of the study.

### 2.2 | Participants

In total, 126 players from 18 different existing competitive basketball teams participated during the last part of the season (March-April). The minimum number of participants required was determined by an a priori power analysis (Gpower 3: Faul et al<sup>39</sup>). This power analysis was based on the results of a previous study with a similar design and comparable hypotheses.<sup>24</sup> The results indicated that 84 participants would be sufficient to detect a significant condition by time interaction effect with a power of 0.96 and an alpha of 0.05.

Six clubs provided one team willing to participate, two clubs provided two teams, and one club provided eight teams. This last club is one of the largest clubs in Belgium, and therefore had much more teams within the targeted age category (U16-U18). The number of players in the teams ranged between 5 and 10, with an average of 7 players. On average, participants were 16 years old ( $SD = 1.25$ ) and had 7 years of basketball experience ( $SD = 3.40$ ). All participants played at a lower

competitive level (ie, regional or provincial level). We chose not to include elite players to allow adequate variety in their performance.

## 2.3 | Experimental design

### 2.3.1 | Procedure

The players filled out a questionnaire a few weeks before the experiment, in which they were asked to rate their teammates' on-field leadership on a scale ranging from 1 (*very bad leader*) to 7 (*very good leader*). Based on the results of this questionnaire, we appointed the player perceived as best leader of the team as that team's athlete leader. During the course of the experiment, each team successively performed the same basketball task twice. The first test served as a baseline assessment, while the second test included the actual experimental manipulation.

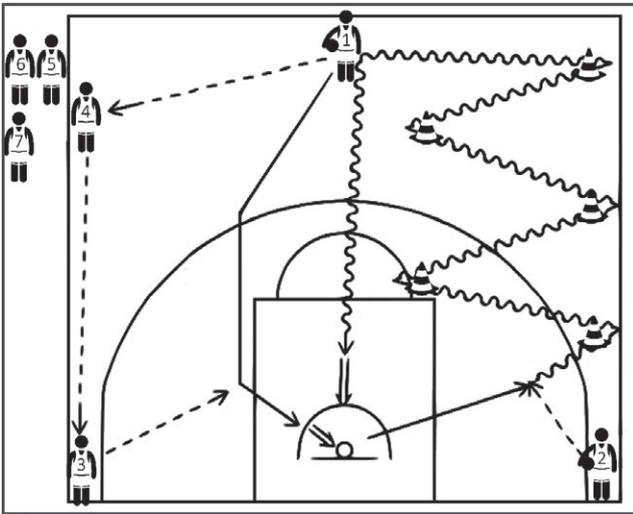
### 2.3.2 | Task

Both test sessions involved the same basketball task, presented in Figure 2, which is based upon the task previously used by Fransen et al<sup>24</sup>. To maximize the task's ecological validity, it was designed to be highly interactive and to represent a variety of basketball-specific skills, such as passing, dribbling, lay-ups, and free-throws. During both test sessions, each player had to perform this task 10 times. Every round included two scoring opportunities, resulting in 20 shots in total (ie, 10 free throws and 10 lay-ups).

### 2.3.3 | Manipulation

We established a baseline measurement during the first test session, in which the coach or athlete leader received no specific directions beyond the formal instructions of the experimental leader on how to execute the exercise. Adopting a  $3 \times 2$  design, using time as within-subjects variable, each participating team was randomly distributed in one of three conditions; (a) competence support by the coach; (b) competence support by the athlete leader; (c) control condition in which no competence support was provided. We standardized each of these conditions using a detailed script, as outlined in more detail below. Supporting Information B provides the full script.

In the coach condition (ie, in which the coach provided competence support), the experimental leader asked the coach after the first test session to provide positive feedback, both at the individual and at the team level. The experimental leader illustrated his instructions by showing the coach a visual scheme (Supporting Information A). This scheme included examples on how to provide competence support for individual players (eg, "Good job, that was a great shot!"),



**FIGURE 2** Player 1 (ie, the athlete leader) starts by passing the ball to Player 4. The ball is immediately passed to Player 3, who in turn passes it back to Player 1 to perform a lay-up. He then receives a new ball from Player 2 and has to dribble along the cones. Player 1 passes the starting point and attempts to score with a free-throw. During the actions of Player 1, every other player in the field rotates counterclockwise. Player 4 replaces Player 3, who takes the rebound for the lay-up and replaces Player 2. Player 2 goes to the starting position and can start the task as soon as the shot of Player 1 hits the board or rim. After Player 1 has finished his round, he gets in line after Player 5. If there are more than five players in a team, the remaining players wait behind Player 5 until it is their turn. To minimize potential learning effects, the players were instructed to practice the exercise twice before starting the actual experiment. Note.  $\rightarrow$  = running without the ball;  $-\rightarrow$  = passing of the ball;  $\sim$  = dribbling with the ball;  $\Rightarrow$  = scoring attempt (A = lay-up; B = free-throw)

as well as on how to provide competence support to the entire team (eg, “Keep going, we are definitely going to be the fastest team if we keep this up!”). With respect to the frequency, the experimental leader asked the coach to provide competence-supportive feedback to the player at least once during every round (ie, one player performing the exercise), and to provide positive feedback at the team level at least once during every five rounds. This brief intervention lasted about two minutes. If the coach did not deliver feedback at the requested frequency, the research confederate reminded him of his task during the second part of the experiment.

In the athlete leader condition (ie, in which the athlete leader provided competence support), the experimental leader instructed the athlete leader after the first baseline measure. The experimental leader informed him of the fact that he was seen as the best leader by his teammates and provided identical instructions as for the coach in the coach condition. Again, a visual scheme (Supporting Information A) was used to illustrate how the athlete leader could provide competence support both at the individual and at the team level. The same frequency of feedback was requested as in

the coach condition, namely once during each round to the player executing the task and once at the team level every five rounds. This intervention also took about two minutes. Also in this case, the research confederate reminded the athlete leader of his task if he did not deliver feedback at the requested frequency. In the control condition, the second test session resembled the baseline test; neither the coach, nor the athlete leader was instructed to provide competence support.

## 2.4 | Measures

Participants filled out a questionnaire after both test sessions. In addition, the experimental leader tracked the frequency of the provided feedback and an additional research assistant tracked the execution time and the number of scores.

### 2.4.1 | Manipulation check

#### 2.4.1.1 | Frequency of feedback

The experimental leader tracked the number of times that the coach and the athlete leader provided competence support either at the individual or at the team level. In this way, we obtained the objective frequency of the total amount of individual- and team-oriented feedback, provided by the coach and the athlete leader.

#### 2.4.1.2 | Perceived competence support

Participants were asked to assess the competence support of both the coach and each team member by rating “the extent to which they helped you to improve, encouraged you, and made you feel like that you performed well during the basketball task” on a scale of 1 (*absolutely not*) to 7 (*very strongly*).

### 2.4.2 | Outcome variables

#### 2.4.2.1 | Competence satisfaction

We used a six-item measure to assess participants’ competence satisfaction, with an example item being “During the previous basketball test, I felt like I could perform well.” These items were based on suggestions from Mouratidis et al<sup>40</sup> Participants rated each team member on a scale from 1 (*absolutely not*) to 7 (*very strongly*). The Cronbach alphas of 0.69 and 0.75 after the first and second test session, respectively, demonstrated sufficient internal consistency of the scale.

#### 2.4.2.2 | Intrinsic motivation

Participants completed a four-item scale on intrinsic motivation as suggested by Mouratidis et al<sup>16</sup> A sample item reads “I tried my best during the previous basketball test, because I

had fun doing so.” Participants had to rate their agreement on a scale varying from 1 (*absolutely not*) to 7 (*very strongly*). The Cronbach alphas of 0.91 and 0.93 after the first and second test session, respectively, demonstrated an excellent internal consistency of this scale.

### 2.4.2.3 | Performance

We assessed both subjective and objective performance. With respect to subjective performance, participants rated their agreement with the following four items; “I/My team can complete the task fast” and “I/My team can perform the task accurately” on a scale from 1 (*absolutely not*) to 7 (*very strongly*). With respect to objective performance, the experimental assistant registered the number of lay-ups and free-throws that the participant scored during one test session. Given that participants had 20 scoring opportunities in total (ie, 10 free throws and 10 lay-ups), their performance *accuracy* score could vary between 0 and 20. Second, the research assistant tracked the time each player needed to complete the task. By adding the individual times per round, we obtained the total time each participant needed to complete his rounds (ie, performance *speed*). To assess the *overall performance*, we added a penalty of five seconds for each missed score, a rule that was communicated to participants before the start of the experiment.

## 2.5 | Statistical analysis

The means, standard deviations, and correlations between all variables are presented in Table 1. Before testing differences as a function of condition assignment, we explored whether the conditions for using parametric tests were met. A Shapiro-Wilk test indicated that the observed distribution of all variables deviated from the normal distribution, with the exception of performance speed and overall performance.

For those variables that did not meet the assumption of normality, we opted for non-parametric analyses. Next, we examined whether the change for any variable within a given condition significantly differed from the observed change in the other conditions. To do so, we first calculated condition-specific change scores and then compared these changes using a Kruskal-Wallis test. The effect size  $\eta^2$  was calculated by dividing the test statistic  $\chi^2$  by the number of observations minus one. In a next step, we determined whether the outcome within a specific condition increased or decreased from Time 1 to Time 2 using a Wilcoxon signed-rank test (ie, pretest vs. posttest). The effect size  $r$  was calculated by dividing the test statistic,  $z$ , by the square of the number of observations. Effect sizes range between 0 and 1, with the benchmarks of  $r = 0.10$  for small effects (explaining 1% of the variance);  $r = 0.30$  for medium effects (explaining 9% of the variance); and  $r = 0.50$  for large effects (explaining 25% of the variance).<sup>41</sup> Table 2 outlines the results of both non-parametric tests.

For the two normally distributed performance variables (ie, performance speed and overall performance), we used  $3 \times 2$  repeated-measures ANOVA's with time as the within-subjects repeated-measure (second vs first test session) and the three conditions as between-subject factors. As post-hoc analysis, we conducted a  $2 \times 2$  repeated-measures ANOVA for each pair of experimental conditions. These results are displayed in Table 3. SPSS 24 was used for all these analyses.

To examine the mediating effect of objective performance and competence satisfaction on players' intrinsic motivation and their subjective performance, we performed Structural Equation Modelling (SEM) using STATA 13. More specifically, we tested the model postulated by Fransen et al<sup>24</sup> (Figure 1) by performing a path analysis. Similar as in the study of Fransen et al<sup>24</sup> we created two dummy variables that represented the experimental conditions in our model, thereby using the control condition as a reference point. The first dummy variable represented competence support by the coach (ie, comparing the situation in which the coach provided competence support (1) to the situation in which no one provided competence support (0)). Similarly, the second dummy variable represented the competence support provided by the athlete leader relative to the control group.

The outcome variables included in this model all reflect improvement over time. For performance accuracy, competence satisfaction, intrinsic motivation, and subjective performance, we calculated the improvement by the posttest score minus the pretest score. For performance speed (assessed by the time the participants needed to complete the exercise), however, we calculated the improvement in speed by subtracting the post-test score from the pretest score as a decrease in time reflects an improvement in performance speed. It should be noted that participants' motivation and their subjective performance were only assessed upon termination of the task (and thus after the objective performance). Therefore, in line with the findings of Fransen et al<sup>24</sup> we modeled objective performance as a potential driver of one's motivational functioning and subjective performance.

## 3 | RESULTS

### 3.1 | Manipulation check

#### 3.1.1 | Competence support by the coach

Kruskal-Wallis tests revealed that the increase in rated frequency of positive feedback and athlete perceived competence support in the coach condition was significantly larger compared to the observed changes in both the athlete leader condition ( $\chi^2(1) = 8.37$ ,  $P < 0.01$ ,  $\eta^2 = 0.10$  and  $\chi^2(1) = 18.46$ ,  $P < 0.001$ ,  $\eta^2 = 0.22$ ) and the control condition ( $\chi^2(1) = 8.34$ ,  $P < 0.01$ ;  $\eta^2 = 0.10$  and  $\chi^2(1) = 7.41$ ,  $P < 0.01$ ,  $\eta^2 = 0.09$ ). Examining the changes within each

**TABLE 1** Means, standard deviations, and correlations between all the included variables

|  | M      | SD    | 1       | 2     | 3      | 4     | 5       | 6      | 7     | 8      |
|--|--------|-------|---------|-------|--------|-------|---------|--------|-------|--------|
| Perceived competence support of the coach at T1          | 4.93   | 1.72  |         |       |        |       |         |        |       |        |
| Perceived competence support of the coach at T2          | 5.05   | 1.92  | 0.61*** |       |        |       |         |        |       |        |
| Frequency of feedback by the coach at T1                 | 10.78  | 19.63 | 0.46    | 0.35  |        |       |         |        |       |        |
| Frequency of feedback by the coach at T2                 | 35.33  | 53.52 | 0.33    | 0.60* | 0.83** |       |         |        |       |        |
| Perceived competence support of the athlete leader at T1 | 4.95   | 1.46  | 0.39*** | 0.36* | 0.99   | 0.94  |         |        |       |        |
| Perceived competence support of the athlete leader at T2 | 5.85   | 1.23  | 0.26*   | 0.25* | 0.99   | 0.94  | 0.51*** |        |       |        |
| Frequency of feedback by the athlete leader at T1        | 5.28   | 4.86  | 0.08    | 0.27  | 0.21   | 0.28  | 0.50    | 0.50   |       |        |
| Frequency of feedback by the athlete leader at T2        | 24.39  | 29.84 | 0.05    | 0.21  | -0.11  | -0.07 | 0.50    | 0.50   | 0.43  |        |
| Competence satisfaction at T1                            | 5.02   | 2.44  | 0.02    | 0.01  | 0.19   | 0.08  | -0.04   | 0.17   | -0.09 | -0.14  |
| Competence satisfaction at T2                            | 4.99   | 1.03  | 0.14    | 0.52  | 0.27   | 0.28  | 0.02    | 0.31** | -0.14 | 0.32   |
| Intrinsic motivation at T1                               | 4.91   | 1.18  | 0.08    | 0.01  | 0.26   | 0.45  | 0.01    | 0.01   | 0.27  | 0.42   |
| Intrinsic motivation at T2                               | 5.01   | 1.27  | 0.09    | 0.05  | 0.20   | 0.36  | 0.06    | 0.17   | 0.19  | 0.45   |
| Subjective performance at T1                             | 4.39   | 1.33  | 0.01    | -0.08 | 0.37   | 0.18  | 0.14    | 0.21*  | -0.06 | -0.01  |
| Subjective performance at T2                             | 5.02   | 1.30  | 0.1     | 0.02  | -0.1   | -0.15 | 0.19*   | 0.29** | -0.17 | 0.33   |
| Performance accuracy at T1                               | 13.48  | 2.41  | -0.09   | -0.03 | 0.27   | 0.12  | 0.07    | 0.10   | -0.17 | -0.23  |
| Performance accuracy at T2                               | 13.50  | 2.43  | -0.03   | -0.07 | 0.01   | -0.03 | -0.02   | -0.01  | 0.01  | 0.01   |
| Performance speed at T1                                  | 147.00 | 13.53 | 0.14    | 0.18  | 0.04   | 0.01  | 0.10    | -0.22* | -0.16 | -0.35  |
| Performance speed at T2                                  | 140.07 | 15.19 | 0.08    | 0.03  | -0.09  | -0.17 | 0.07    | -0.22* | -0.20 | -0.49* |
| Total performance at T1                                  | 179.58 | 17.96 | 0.17    | 0.15  | -0.12  | -0.06 | 0.03    | -0.23* | -0.05 | -0.21  |
| Total performance at T2                                  | 172.57 | 21.41 | 0.07    | 0.06  | -0.07  | -0.11 | 0.06    | -0.15  | -0.14 | -0.35  |

Performance accuracy = number of shots scored / Performance speed = time needed to perform the task / Total performance = time + 5s \* # missed shots.

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

condition, the results of Wilcoxon signed-rank tests revealed that the feedback provided by the coach and the experienced competence support by the athletes significantly increased in the coach condition over time ( $r = -0.90$ ,  $P < 0.05$  and  $r = -0.57$ ,  $P < 0.001$ ), an increase that was not observed in the athlete leader and the control condition. These findings indicate that the manipulations were successful.

### 3.1.2 | Competence support by the athlete leader

Kruskal-Wallis tests revealed that the increase in rated frequency of provided feedback in the athlete leader condition was significantly larger compared to the observed changes in both the coach condition ( $\chi^2(1) = 5.06$ ,  $P < 0.05$ ,  $\eta^2 = 0.06$ ) and the control condition ( $\chi^2(1) = 8.37$ ,  $P < 0.01$ ,  $\eta^2 = 0.10$ ). In addition, the increase in athlete perceived competence support was significantly larger in the athlete

leader condition than in the coach condition ( $\chi^2(1) = 5.74$ ,  $P < 0.05$ ,  $\eta^2 = 0.07$ ). However, in contrast to our intentions, no significant difference with the control condition emerged. Examining the changes within each condition, the results of Wilcoxon signed-rank tests revealed that the athlete leader's competence support as experienced by the other athletes significantly increased in each of the three conditions (coach condition:  $r = -0.45$ ,  $P < 0.01$ ; athlete leader condition:  $r = -0.74$ ,  $P < 0.001$ ; control condition:  $r = -0.60$ ,  $P < 0.01$ ). Although the increase is strongest in the athlete leader condition, the fact that we also observe an increase in the coach and control condition is not in line with our intended manipulation. On the other hand, the objective amount of feedback provided by the athlete leader only increased significantly in the athlete leader condition ( $r = -0.75$ ,  $P < 0.05$ ), an increase that was not observed in both other conditions, which is in line with our intended manipulation.

TABLE 1 (Continued)

| 9      | 10      | 11      | 12      | 13      | 14      | 15       | 16       | 17      | 18      | 19     |
|--------|---------|---------|---------|---------|---------|----------|----------|---------|---------|--------|
| 0.29** |         |         |         |         |         |          |          |         |         |        |
| 0.11   | 0.42*** |         |         |         |         |          |          |         |         |        |
| 0.08   | 0.54*** | 0.75*** |         |         |         |          |          |         |         |        |
| 0.25** | 0.35*** | 0.14    | 0.122   |         |         |          |          |         |         |        |
| 0.14   | 0.6***  | 0.09    | 0.31*** | 0.22*   |         |          |          |         |         |        |
| 0.19*  | 0.24**  | -0.03   | -0.06   | 0.47*** | 0.09    |          |          |         |         |        |
| 0.24** | 0.25**  | -0.01   | 0.00    | 0.13    | 0.31*** | 0.49***  |          |         |         |        |
| -0.07  | -0.14   | -0.09   | -0.13   | 0.14    | -0.04   | 0.02     | -0.17    |         |         |        |
| -0.09  | -0.12   | -0.08   | -0.14   | 0.16    | -0.1    | -0.06    | -0.22*   | 0.83*** |         |        |
| -0.18* | -0.26** | -0.05   | -0.06   | -0.23** | -0.09   | -0.66*** | -0.46*** | 0.74*** | 0.66*** |        |
| -0.20* | -0.23*  | -0.05   | -0.1    | 0.04    | -0.25** | -0.32*** | -0.72*** | 0.68*** | 0.83*** | 0.73** |

These contrasting findings mean that, while the athlete leader objectively provided more positive feedback when requested (ie, only in the athlete leader condition), the other players also perceived competence support by the athlete leader when he was not asked to provide positive feedback (ie, in the coach and control condition). In an attempt to identify the reason behind this contrast, we assessed the competence support provided by the other athletes in the team. That is, we asked participants to what extent the other athletes in the team (with exception of the athlete leader) provided positive feedback. Our findings revealed that the perceived competence support of the other athletes increased significantly, not only in the athlete leader condition ( $r = -0.52$ ,  $P < 0.05$ ), but also in the coach condition ( $r = -0.52$ ,  $P < 0.05$ ). The contagion phenomenon<sup>42</sup> in the latter condition could explain why also the athlete leader was perceived to provide competence support. More specifically, this phenomenon asserts that by expressing different moods and emotions, both

verbally and non-verbally, people can strongly influence the emotions and feelings of a group around them. This is especially true for people who occupy a hierarchical position, such as the coach.<sup>43-45</sup> In the coach condition, the experienced positive competence support by the coach might thus have spread throughout the team. As a result, not only the perceived competence support of the other athletes increased, but also that of the athlete leader, explaining our unexpected observation in the coach condition.

## 3.2 | Impact of coaches and athlete leaders on outcome variables

### 3.2.1 | Athlete-reported outcomes

Kruskal-Wallis tests revealed that while the coach condition failed to produce a larger change in athletes' competence satisfaction compared to the control condition, the athlete leader

**TABLE 2** The results of the Wilcoxon signed-rank test and Kruskal-Wallis test

|  | <i>M</i> at Time 1 (SD) | <i>M</i> at Time 2 (SD) | Wilcoxon signed-rank test ( <i>Z</i> ) | Kruskal-Wallis test ( $\chi^2$ ) |                          |
|--|-------------------------|-------------------------|--|----------------------------------|--------------------------|
|  |                         |                         |  | Coach condition                  | Athlete leader condition |
| Perceived competence support by the coach          |                         |                         |  |                                  |                          |
| Coach condition                                    | 5.4 (1.5)               | 6.1 (1.4)               | -3.77***                               |                                  |                          |
| Athlete leader condition                           | 4.2 (1.8)               | 4.0 (2.0)               | -1.00                                  | 7.41**                           |                          |
| Control condition                                  | 5.1 (1.7)               | 4.9 (1.7)               | -2.00*                                 | 18.46***                         | 0.98                     |
| Frequency of feedback by the coach                 |                         |                         |  |                                  |                          |
| Coach condition                                    | 23.7 (30.1)             | 93.8 (58.4)             | -2.20*                                 |                                  |                          |
| Athlete leader condition                           | 7.0 (9.1)               | 7.5 (9.2)               | -0.41                                  | 8.37**                           |                          |
| Control condition                                  | 1.7 (2.7)               | 4.7 (9.1)               | -0.32                                  | 8.34**                           | 0.03                     |
| Perceived competence support by the athlete leader |                         |                         |  |                                  |                          |
| Coach condition                                    | 4.7 (1.0)               | 5.0 (1.0)               | -2.96**                                |                                  |                          |
| Athlete leader condition                           | 4.7 (0.6)               | 6.1 (0.4)               | -4.25***                               | 5.74*                            |                          |
| Control condition                                  | 4.6 (1.0)               | 5.1 (0.8)               | -3.01**                                | 0.99                             | 0.84                     |
| Frequency of feedback by the athlete leader        |                         |                         |  |                                  |                          |
| Coach condition                                    | 8.0 (6.7)               | 20.5 (31.8)             | -1.84                                  |                                  |                          |
| Athlete leader condition                           | 5.3 (3.6)               | 49.2 (26.9)             | -2.20*                                 | 5.06*                            |                          |
| Control condition                                  | 2.5 (2.1)               | 3.5 (4.0)               | -0.80                                  | 0.33                             | 8.37**                   |
| Satisfaction of need for competence                |                         |                         |  |                                  |                          |
| Coach condition                                    | 22.4 (4.5)              | 23.6 (4.4)              | -1.33                                  |                                  |                          |
| Athlete leader condition                           | 22.7 (4.7)              | 24.9 (4.8)              | -2.70**                                | 1.33                             |                          |
| Control condition                                  | 23.5 (8.8)              | 23.5 (5.8)              | -1.64                                  | 0.49                             | 4.16*                    |
| Intrinsic motivation                               |                         |                         |  |                                  |                          |
| Coach condition                                    | 4.9 (1.4)               | 4.9 (1.3)               | -0.51                                  |                                  |                          |
| Athlete leader condition                           | 5.0 (1.1)               | 5.2 (1.1)               | -2.31*                                 | 2.56                             |                          |
| Control condition                                  | 4.9 (1.0)               | 4.9 (1.4)               | -0.05                                  | 0.02                             | 1.43                     |
| Subjective performance                             |                         |                         |  |                                  |                          |
| Coach condition                                    | 4.2 (1.4)               | 5.0 (1.1)               | -2.71**                                |                                  |                          |
| Athlete leader condition                           | 4.6 (1.4)               | 5.3 (1.1)               | -2.73**                                | 0.32                             |                          |
| Control condition                                  | 4.4 (1.1)               | 4.8 (1.6)               | -1.66                                  | 0.40                             | <0.001                   |
| Performance accuracy (ie, number of shots scored)  |                         |                         |  |                                  |                          |
| Coach condition                                    | 13.8 (2.7)              | 14.4 (2.4)              | -1.51                                  |                                  |                          |
| Athlete leader condition                           | 14.1 (2.0)              | 14.0 (2.3)              | -0.73                                  | 2.90                             |                          |
| Control condition                                  | 12.5 (2.2)              | 12.0 (1.9)              | -2.2*                                  | 6.82**                           | 0.18                     |

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

condition did ( $\chi^2(1) = 4.16$ ,  $P < 0.05$ ,  $\eta^2 = 0.05$ ). The coach and athlete leader condition did not differ significantly from each other. Examining the changes within each condition,

Wilcoxon signed-ranked tests revealed that participants' competence satisfaction increased significantly in the athlete leader condition ( $r = -0.37$ ,  $P < 0.05$ ), while a similar

**TABLE 3** The results of the  $3 \times 2$  repeated-measures ANOVA's with the outcome variables as dependent variables, time (second vs. first test session) as the within-subjects repeated measure, and the experimental conditions as the between-subjects factors, including the results of the post-hoc analyses of the interaction effects

|   | <i>M</i> at first session (SD) | <i>M</i> at second session (SD) | Main time effect ( <i>F</i> ) | Interaction effect time $\times$ condition ( <i>F</i> ) | Post-hoc tests  |                          |
|---|--------------------------------|---------------------------------|-------------------------------|---|-----------------|--------------------------|
|   |                                |                                 |                               |   | Coach condition | Athlete leader condition |
| Performance speed (i.e., time needed to perform the task) |                                |                                 |                               |   |                 |                          |
| Coach condition   | 145.0 (11.7)                   | 133.4 (8.8)                     | 98.19***                      | 23.19***  |                 |                          |
| Athlete leader condition                                  | 143.5 (13.6)                   | 135.8 (15.2)                    |                               |   | 5.53*           |                          |
| Control condition   | 153.3 (13.6)                   | 152.8 (13.7)                    |                               |   | 43.80***        | 21.31***                 |
| Total performance (time + 5s * # missed shots)            |                                |                                 |                               |   |                 |                          |
| Coach condition   | 176.2 (18.6)                   | 161.6 (15.4)                    | 29.89***                      | 16.77***  |                 |                          |
| Athlete leader condition                                  | 173.1 (13.9)                   | 166.0 (17.5)                    |                               |   | 6.83*           |                          |
| Control condition   | 190.8 (16.1)                   | 193.1 (17.0)                    |                               |   | 35.60**         | 9.62**                   |

The post-hoc analyses represent the interaction effect of a  $2 \times 2$  repeated-measures ANOVA for each pair of experimental conditions.

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

change was not observed in either the coach or the control condition. These findings are in contrast with H1a, but confirm H2a. Although the Kruskal–Wallis test revealed no significant difference in competence satisfaction between the coach and the athlete leader condition, the Wilcoxon signed-ranked tests pointed to a difference. Specifically, athlete leaders did influence their teammates' competence satisfaction while the coach did not.<sup>a</sup>

Next, Kruskal–Wallis tests revealed no significant differences in either intrinsic motivation or subjective performance between the three conditions. Follow-up Wilcoxon signed-rank tests revealed no significant changes over time in the control condition in any of these outcomes. In line with H2b and H2c, a significant increase over time was observed in the athlete leader condition for both intrinsic motivation ( $r = -0.36$ ,  $P < 0.05$ ) and subjective performance ( $r = -0.37$ ,  $P < 0.05$ ). In the coach condition, no parallel increase in intrinsic motivation was observed, while a significant increase in subjective performance did emerge

( $r = -0.40$ ,  $P < 0.01$ ). These findings are in contrast to H1b, but are in line with H1c.

### 3.2.2 | Objective performance

The overall performance was a combined measure of speed and accuracy, calculated by adding five penalty seconds to their execution time for each missed scoring opportunity (ie, shots or lay-ups). Repeated-measures ANOVA revealed a significant interaction effect ( $F = 16.77$ ,  $P < 0.001$ ) between the three conditions. Post-hoc tests demonstrated significant interaction effects between the coach and the control condition ( $F = 35.60$ ,  $P < 0.01$ ), between the athlete leader and the control condition ( $F = 9.62$ ,  $P < 0.01$ ), and between the coach condition and the athlete leader condition ( $F = 6.83$ ,  $P < 0.05$ ). These results reveal that participants in both competence-supportive conditions performed better than participants in the control condition, thereby confirming H1d and H2d. However, the impact of the coach on participants' objective performance is larger than the impact of the athlete leader.

Next, we broke the composite performance score in its subcomponents (ie, speed and accuracy) to examine their separate effects. First, with respect to speed (ie, the time needed to perform the task), Repeated-measures ANOVA revealed a significant interaction effect ( $F = 23.19$ ,  $P < 0.001$ ) between the three conditions. Post-hoc tests demonstrated a significant interaction effect for execution speed between the coach and the control condition ( $F = 43.80$ ,  $P < 0.001$ ) as well as between the athlete leader and the control condition

<sup>a</sup>We also included a 12 item measure, developed by Chen et al<sup>46</sup>, to examine whether our manipulation impacted competence explicitly or instead affected all three needs (i.e., competence, autonomy, relatedness) identified in Self-Determination Theory. More specifically, we assessed participants' satisfaction and frustration of these three needs. Additional analyses revealed no significant differences between conditions for either autonomy or relatedness satisfaction. Similarly, no differences were found between conditions for need frustration on any of these three needs. These findings confirm that our manipulation solely affected participants' competence satisfaction, as intended.

( $F = 21.31$ ,  $P < 0.001$ ). These findings indicate that players executed the task faster when receiving competence support, regardless of the source of competence support. Moreover, players executed the task faster when the coach provided competence support than when athlete leaders did ( $F = 5.53$ ,  $P < 0.05$ ).

Second, with respect to scoring accuracy (ie, the number of scored shots), which deviated from the normal distribution, Kruskal–Wallis tests revealed a significant difference in accuracy between the coach condition and the control condition ( $\chi^2(1) = 6.82$ ,  $P < 0.01$ ,  $\eta^2 = 0.08$ ). However, such a difference did not occur between the athlete leader and the control condition. This implies that while players are more successful in their scoring opportunities when the coach provides competence support compared to the control condition, this is not the case when the athlete leader provides competence support. The coach and the athlete leader condition did not differ significantly from each other. More specifically, while the Wilcoxon signed-rank tests demonstrated no significant changes in accuracy over time for the coach or the athlete leader condition, they did reveal a significant drop in accuracy over time for the control condition ( $r = -0.36$ ,  $P < 0.05$ ).

### 3.3 | Sensitivity analysis

As participants were part of different teams, we performed a sensitivity analysis to control for the clustered nature of our data. Using the statistical program R 3.4.4, we implemented multilevel regression modeling and compared those results with

the original results. We included time as a Level 1-predictor, condition as a Level 2-predictor, and a random intercept as Level 3-predictor, which controls for biased results that can occur due to nesting. The results of these multilevel regression modeling analyses are presented in Table 4 and corroborate all interaction effects found previously when controlling for clustering. There was only one exception; while our original results revealed that the athlete leader condition produced a larger change in athletes' competence satisfaction compared to the control condition, this interaction effect was only marginally significant when controlling for clustering ( $P = 0.05$ ). In general, we can conclude that our original analyses were robust and provide accurate insight in our nested data.

### 3.4 | Explanatory role of motivational processes

In the path analyses, we initially tested the model proposed in Figure 1. Two modifications were made to improve the model fit, that is, a direct relation between performance accuracy and competence satisfaction was added and the path between performance accuracy and performance speed was removed. The final model confirmed the proposed dual pathway model, involving a motivational route and a performance-related route, presented in Figure 3. This model yielded a very good fit to our data according to the guidelines suggested by Hooper et al<sup>47</sup> ( $\chi^2(8) = 8.74$ ,  $P = 3.37$ , CFI = 0.99, TLI = 0.98, RMSEA = 0.03, pclose = 0.57, SRMR = 0.04). The motivational pathway showed that experimentally induced

**TABLE 4** The results of the multilevel regression modeling, including time as a level 1-predictor, condition as a level 2-predictor, and a level 3 random intercept. The table displays interaction effects between all conditions and between all three combinations of two conditions

|   | All conditions                 |                     | Coach and control condition    |                     | Athlete leader and control condition |                     | Coach and athlete leader conditions |                     |
|---|--------------------------------|---------------------|--------------------------------|---------------------|--------------------------------------|---------------------|-------------------------------------|---------------------|
|   | Interaction effect ( $\beta$ ) | Standard error (SE) | Interaction effect ( $\beta$ ) | Standard error (SE) | Interaction effect ( $\beta$ )       | Standard error (SE) | Interaction effect ( $\beta$ )      | Standard error (SE) |
| Satisfaction of need for competence                     | -0.09                          | 0.07                | -0.07                          | 0.07                | -0.21 <sup>o</sup>                   | 0.11                | 0.19                                | 0.19                |
| Intrinsic motivation                                    | 0.01                           | 0.06                | 0.02                           | 0.06                | -0.11                                | 0.10                | 0.29                                | 0.17                |
| Subjective performance                                  | -0.11                          | 0.12                | -0.10                          | 0.12                | -0.11                                | 0.19                | -0.09                               | 0.35                |
| Total performance (time + 5s * # missed shots)          | 5.52 <sup>***</sup>            | 0.96                | 5.62 <sup>***</sup>            | 0.94                | 4.67 <sup>**</sup>                   | 1.50                | 7.52 <sup>**</sup>                  | 2.84                |
| Performance speed (ie, time needed to perform the task) | 3.70 <sup>***</sup>            | 0.54                | 3.70 <sup>***</sup>            | 0.55                | 3.62 <sup>***</sup>                  | 0.77                | 3.88 <sup>*</sup>                   | 1.63                |
| Performance accuracy (ie, number of shots scored)       | -0.37 <sup>*</sup>             | 0.17                | -0.38 <sup>*</sup>             | 0.17                | 2.72                                 | 1.65                | -0.72                               | 0.55                |

<sup>o</sup> $P = 0.05$ ;  $*$  $P < 0.05$ ;  $**P < 0.01$ ;  $***P < 0.001$ .

athlete leader competence support predicted an increase in players' competence satisfaction, which in turn nurtured their intrinsic motivation, confirming H3a. Both intrinsic motivation and competence satisfaction predicted players' subjective performance. Although the manipulated coach competence support had no direct effect on players' competence satisfaction, the coach did so in an indirect way. More specifically, via affecting the performance pathway (ie, by influencing players' accuracy, which in turn influenced their competence perceptions).

The performance-based pathway was in line with our expectations, confirming H3b, in that the competence support of the coach directly influenced players' speed and their accuracy. However, the athlete leader only influenced players' execution speed, and not their accuracy. In turn, both of these two objective performance variables (ie, speed and accuracy) predicted players' subjective performance.

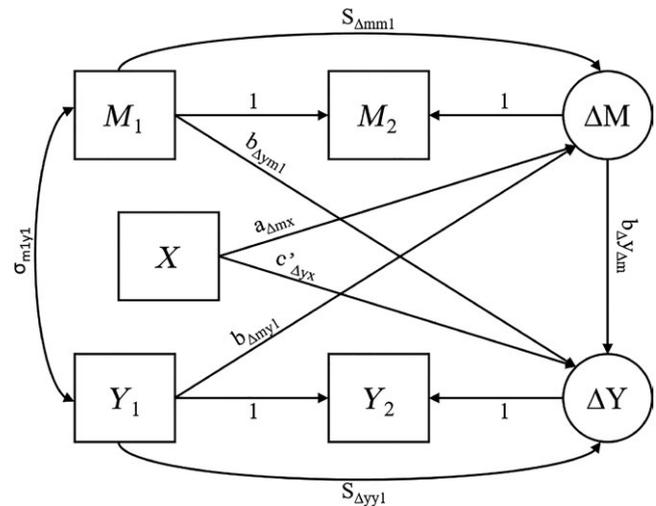
As a final step, we wanted to confirm the results provided by the path analysis, as difference scores have been criticized previously (see Henk and Castro-Schilo<sup>48</sup> for an historical overview). To do so, we implemented the suggestions of Valente and MacKinnon<sup>49</sup> and assessed the mediation using analyses of covariance (ANCOVA) fitted with the latent change score (LCS) specification. In order to be able to fit our original model (Figure 3) to the model suggested by Valente and MacKinnon<sup>49</sup> (Figure 4), we performed 10 separate ANCOVA's fitted with the LCS specification. These results displayed in Table 5 corroborate our previous findings on the dual pathway and the impact of coaches and athlete leaders.

### 4 | DISCUSSION

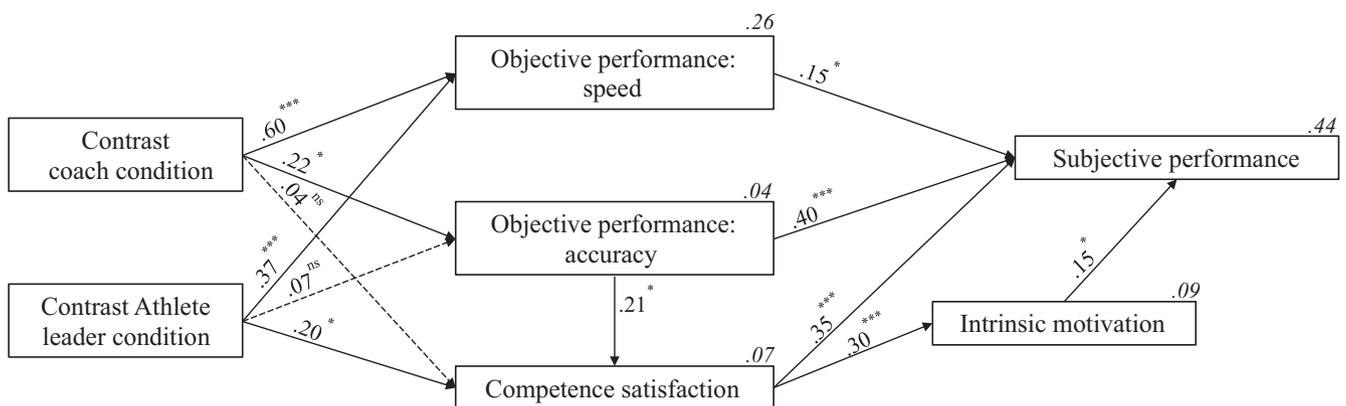
The aim of this research was to investigate the impact of the coach and the athlete leader on their team's competence, intrinsic motivation, and performance. To maximize

the ecological validity of the study, we sampled existing teams and instructed the actual coach and actual athlete leader of the team to provide competence support instead of working with research confederates who are unfamiliar to the athletes.

Our findings reveal that if coaches and athlete leaders increase their competence-support, team members' performance is immediately enhanced. This finding corroborates the general literature on how both coaches<sup>24,50-52</sup> and athlete leaders<sup>14,37,53</sup> can affect performance. However, the present study also provides some novel insights. First, the coach has



**FIGURE 4** Path diagram of analyses of covariance (ANCOVA) fitted with the latent change score (LCS) specification. The second wave of the mediator and the outcome are included as a unit-weighted function of pretest and a new unobserved change variable ( $\Delta M$  and  $\Delta Y$ ) to mimic subtracting pretest scores from posttest scores on the respective variables. The diagram includes pretest correlation between mediator and dependent variable ( $\sigma_{my1}$ ), stability of mediator ( $S_{\Delta mm1}$ ), stability of dependent variable ( $S_{\Delta yy1}$ ),  $\Delta Y$  cross-lag ( $b_{\Delta ym1}$ ),  $\Delta M$  cross-lag ( $b_{\Delta my1}$ ), effect of  $X$  on  $\Delta M$  ( $a_{\Delta mx}$ ), effect of  $X$  on  $\Delta Y$  ( $c'_{\Delta yx}$ ), and effect of  $\Delta M$  on  $\Delta Y$  ( $b_{\Delta y\Delta m}$ )



**FIGURE 3** Structural model, representing the influence of competence support on participants' objective performance and competence satisfaction. All variables represent the improvement over time. Standardized regression coefficients are included (\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ ), as well as the proportions of explained variance (in italics)

**TABLE 5** The results of analyses of covariance (ANCOVA) fitted with the latent change score (LCS) specification. Figure 4 provides a visual scheme of these analyses

| Mediating variable ( <i>M</i> )                       | Dependent variable ( <i>Y</i> )     | a path (SE)    | b path (SE)    | c' path (SE) | Med Effect (SE) |
|---|-------------------------------------|----------------|----------------|--------------|-----------------|
| Competence support by the coach ( <i>X</i> )          |                                     |                |                |              |                 |
| Performance speed                                     | Subjective performance              | 7.47*** (1.46) | 0.11*** (0.02) | -0.27 (0.22) | 0.81* (0.12)    |
| Performance accuracy                                  | Subjective performance              | 1.09** (0.39)  | 0.23*** (0.06) | -0.28 (0.23) | 0.25* (0.11)    |
| Performance accuracy                                  | Satisfaction of need for competence | 1.16*** (0.38) | 0.09** (0.04)  | -0.19 (0.17) | 0.11* (0.05)    |
| Satisfaction of need for competence                   | Subjective performance              | -0.06 (0.17)   | 0.86*** (0.12) | 0.02 (0.19)  | -0.05 (0.14)    |
| Satisfaction of need for competence                   | Intrinsic motivation                | -0.08 (0.15)   | 0.39*** (0.10) | -0.16 (0.13) | -0.03 (0.06)    |
| Competence support by the athlete leader ( <i>X</i> ) |                                     |                |                |              |                 |
| Performance speed                                     | Subjective performance              | 3.92* (1.47)   | 0.10* (0.02)   | 0.26 (0.24)  | 0.40* (0.05)    |
| Performance accuracy                                  | Subjective performance              | 0.28 (0.44)    | 0.21*** (0.06) | 0.28 (0.21)  | 0.06 (0.10)     |
| Performance accuracy                                  | Satisfaction of need for competence | 0.24 (0.44)    | 0.08* (0.04)   | 0.26 (0.16)  | 0.02 (0.04)     |
| Satisfaction of need for competence                   | Subjective performance              | 0.29* (0.16)   | 0.85*** (0.12) | 0.09 (0.18)  | 0.24* (0.14)    |
| Satisfaction of need for competence                   | Intrinsic motivation                | 0.28* (0.15)   | 0.38*** (0.11) | 0.16 (0.16)  | 0.11* (0.06)    |

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

a larger direct impact on participants' objective performance than the athlete leader. Specifically, when breaking down the composite score into its constituting components (ie, speed and accuracy), it appeared that coaches positively influenced both players' speed and accuracy, while athlete leaders only affected teammates' speed.

A possible explanation for this discrepant influence of coaches and athlete leaders is that scoring depends on a technical basketball skill (ie, a shot or lay-up). Research in the field of motor learning through direct instruction shows that, when the goal of an instruction is the acquisition of a basic skill, then a direct teaching style (ie, the teacher instructs a student) is superior to learner-centered instruction (ie, students instruct each other).<sup>54,55</sup> A potential underpinning reason for this observation is that athletes might feel that their athlete leader, a peer, is not able to provide more in-depth technical advice about scoring above and beyond their own knowledge.<sup>56-59</sup> Yet, the provided positive feedback by the peer may lead them to put extra effort in the activity such that the exercises are executed more quickly. Related to this explanation is the possibility that the feedback provided by coaches and athlete leaders is qualitatively different. That is, coaches might be more proficient in providing technical feedback, because of their training to become a coach. As a result, coaches' feedback might have a stronger impact on players' ability to score their shots.

A second difference between coaches and athlete leaders is that only when the athlete leaders (and not the coaches)

provided competence support, participants reported enhanced competence satisfaction and intrinsic motivation compared with the control group. These findings corroborate previous literature on the positive impact of athlete leaders in general (for a review, see Cotterill and Fransen<sup>60</sup>), and more specifically on the positive motivational outcomes when athlete leaders engage in providing competence support.<sup>14,24</sup> The lack of a direct impact of the coach on this motivational pathway contradicts earlier literature on the positive impact of coaches' competence support (for a review, see Horn<sup>61</sup>). For example, Fransen et al<sup>24</sup> observed earlier that competence support by the coach did increase athletes' competence satisfaction and intrinsic motivation to an extent that was similar compared to when the athlete leader provided competence support. However, it should be noted, that in this earlier experiment, a research confederate with specific training in providing competence support acted as the coach of the team, and not the actual coach of the team, as was the case in our experiment. Results from the present study thus suggest that coaches are able to have a direct impact on their team's competence satisfaction, but they may require more specific training to do so. Unlike coaches, athlete leaders are able to achieve a significant impact with only a brief intervention. This leads us to the conclusion that coaches can adopt two strategies to improve sport teams' motivational functioning. Coaches can either follow an intervention program to learn how to provide competence support more effectively<sup>24,62</sup> or they can use the

TABLE 5 (Continued)

| Pretest Cov. (SE) | Y1 – ΔM (SE)   | M1 – ΔY (SE)   | M Stab (SE)     | Y Stab (SE)     | Δχ <sup>2</sup> (df) | CFI  | RMSEA  |
|-------------------|----------------|----------------|-----------------|-----------------|----------------------|------|--------|
| 2.08 (1.37)       | 0.51 (0.53)    | –0.10 (0.01)   | –0.11* (0.05)   | –0.77*** (0.10) | 2.80 (2)             | 1.00 | 0.06   |
| 1.48*** (0.26)    | –0.17 (0.17)   | 0.10 (0.07)    | 0.48 (0.09)     | –0.74 (0.10)    | 4.56 (2)             | 0.96 | 0.10   |
| 0.75*** (0.22)    | –0.01 (0.20)   | 0.08 (0.04)    | –0.52*** (0.09) | –0.46*** (0.09) | 2.31 (2)             | 1.00 | 0.04   |
| 0.64*** (0.13)    | 0.08 (0.08)    | 0.54*** (0.16) | –0.49*** (0.10) | –0.90*** (0.08) | 1.54 (2)             | 1.00 | <0.001 |
| 0.27** (0.10)     | 0.31*** (0.06) | 0.15 (0.10)    | –0.53*** (0.08) | –0.27*** (0.07) | 0.69 (2)             | 1.00 | <0.001 |
| 2.12 (1.37)       | 0.90 (0.61)    | –0.01 (0.01)   | –0.10 (0.06)    | –0.78*** (0.10) | 5.55 (2)             | 0.97 | 0.11   |
| 1.48*** (0.26)    | –0.25 (0.17)   | 0.07 (0.06)    | –0.45*** (0.09) | –0.73*** (0.09) | 4.14 (2)             | 0.96 | 0.09   |
| 0.75*** (0.22)    | –0.07 (0.22)   | 0.06 (0.04)    | –0.50*** (0.09) | –0.44*** (0.09) | 4.59 (2)             | 0.97 | 0.10   |
| 0.64*** (0.13)    | 0.06 (0.08)    | 0.54*** (0.16) | –0.47*** (0.10) | –0.90*** (0.08) | 3.22 (2)             | 0.99 | 0.07   |
| 0.27** (0.10)     | 0.31*** (0.06) | 0.15 (0.10)    | –0.53*** (0.08) | –0.27*** (0.07) | 0.19 (2)             | 1.00 | <0.001 |

power of their athlete leaders more effectively by encouraging them to provide competence support.

There might be alternative reasons why coaches did not have the same motivational impact as athlete leaders. First, although coaches did not directly affect team members' intrinsic motivation, they might have nurtured other, more controlled forms of motivation. For example, when a coach provides feedback to a player, that player might be motivated to exert effort to meet the expectations of the coach or to prove his worth and ability to the coach (ie, extrinsic rather than intrinsic motivation). To the extent that coaches have primed these alternative types of motivation, they may have partially cancelled out the benefits of coach feedback on intrinsic motivation. In contrast, athlete leaders may have merely promoted their teammates' enjoyment and challenge seeking as such (ie, intrinsic motivation). Future research could examine coaches' and athlete leaders' impact on a broader spectrum of motivational outcomes.

Second, one might argue that in regular sport settings coaches provide more frequent feedback than athlete leaders. While the coach feedback in this experiment may thus have been perceived as the norm (and athletes may have become less sensitive to its positive impact), the behavior displayed by the athlete leader in this experiment may have deviated more strongly from daily practice and therefore might have been experienced as “refreshing” and intrinsically motivating. Research into stimulus novelty revealed that when people experience something new, they see it has a potential for

rewarding them, which motivates them.<sup>63</sup> However, the brain learns that the stimulus, once familiar, has no reward associated with it and as a consequence loses its motivating potential. One counterargument for this reasoning is, although, that our manipulation check revealed that coaches only provided very little competence support in the baseline test. In addition, the increase in coaches' competence support during the experiment was similar as the increase observed for the athlete leaders.

A third potential reason for the larger motivational impact of athlete leaders might be that athletes are used to receive both positive, corrective, and negative feedback from their coaches. The invariantly positive feedback received in this study may have caused players to perceive the feedback to be less authentic. This perceived lack of authenticity could explain its reduced effectiveness.<sup>64</sup> It should be noted, however, that at the end of the questionnaire, we asked participants whether the behavior of the coach and the athlete leader was different during the test, compared to regular training sessions or competitive games. Participants in all experimental conditions indicated that both leaders did not behave differently during the experiment, thereby providing a counterargument for the less authentic feedback.

Although coaches did not affect the motivational pathway directly (as athlete leaders did), it should be noted that they were able to affect this motivational pathway in an indirect way through their impact on players' performance. More specifically, by providing competence support, coaches

were able to influence players' accuracy, which in turn strengthened their competence satisfaction and their intrinsic motivation.

#### 4.1 | Strengths, limitations, and future research

This study is part of a line of research experimentally evidencing the impact of leaders' competence support<sup>14,22,24,61</sup>. The main aim of this study was to see whether earlier observations would also hold in a more ecologically valid context (ie, a context with a stronger external validity). In other words, we aimed to see whether results found in earlier research using confederates hold true when manipulating the behavior of the actual coach and athlete leader in existing teams. To ensure that all coaches and athlete leaders received exactly the same treatment, we adopted a very strict protocol for our intervention with limited room for confounding factors. In addition, we included complete teams instead of artificial teams of five players. Finally, we used a task that required a high level of interaction. Besides the ecological validity of the study's design, also its experimental nature constitutes a clear strength as it allows examining causality. Both for coaches and for athlete leaders, there are only very few studies examining the impact of competence support by means of an experimental study design.

Despite the experimental design and its ecological validity, the present study also had a number of limitations. First, this study focused on one specific dimension of competence support (ie, providing positive feedback). Although the study findings highlighted the role of athlete leaders in influencing teammates' competence satisfaction and their intrinsic motivation, coaches might have a more decisive role when it comes to other types of competence support, such as the providing task- and process-based feedback, creating structured environments and providing optimal challenges. Future research could provide more insight in this matter by investigating these other components of competence support.

Second, the intervention used in this study was only a short-term intervention to manipulate the behavior of the leaders (ie, asking them to provide more positive feedback). A short intervention (about 2 minutes) may not suffice for coaches to alter their standard motivating style. Moreover, a strong deviation from their usual motivating style may be perceived as inauthentic or even awkward by athletes, such that the perceived behavioral changes do not translate into any motivational or performance benefits. Future research could examine whether the effectiveness of the intervention could be maximized by increasing the length of the intervention. In such a design, coaches and athlete leaders would receive a more in-depth training on how to provide competence support. As previous findings suggest, it can be expected in this

case that also coaches would get a direct impact on players' motivational chain.<sup>24</sup>

Third, given the limited duration of our intervention, this study only provides insight in the short-term effects on motivation and performance. An interesting avenue for future research would be to identify long-term effects of leaders' competence-supportive behavior on athletes' motivation and performance throughout a season. As Lewthwaite and Wulf<sup>25</sup> have suggested that motivational variables affect not only motor performance but also motor learning, future research could provide more insight in the impact of competence support on performance (ie, short-term improvement) and learning (ie, long-lasting improvement) by adopting a longitudinal design.

Fourth, we did not differentiate in the quality of feedback provided during the experiment. More specifically, coaches and athlete leaders received instructions on how to provide positive competence-supporting feedback, but we only tracked the quantity of feedback. We did thus not track the enthusiasm with which coaches and athlete leaders provided feedback or the tone of voice used to deliver the feedback (ie, loud or silently). The work of Carpentier and Mageau<sup>65</sup> revealed that athletes' outcomes (ie, well-being, self-esteem, need satisfaction, and performance) are better predicted by feedback quality, compared to the quantity of feedback. More recently, De Muynck et al<sup>23</sup> emphasized the impact of both feedback's valence (ie, positive or negative) and its style (ie, autonomy-supportive or controlling) on players' need satisfaction.

#### 4.2 | Perspective

The present research demonstrates that positive competence support by both coaches and athlete leaders has a positive impact on team performance. However, these results also corroborate previous literature emphasizing the different impact of coaches and athlete leaders.<sup>32,66</sup> These differences could imply that coaches and athlete leaders might be best suited to fulfill different roles. Based on these findings, athlete leaders might be most effective when adopting a motivating role. Coaches, on the other hand, are better suited to enhance players' performance. Thus, an important message to coaches is to engage their athlete leaders to provide competence support, because coaches not only already have a wide range of leadership tasks, but also as their athlete leaders are actually better in some of these leadership tasks (eg, motivating team members). This study has demonstrated that a very brief intervention (ie, just asking them to provide more competence support) already has major motivational benefits for the team. In conclusion, the results of this experimental study suggest that a model of shared leadership, in which coaches engage their athlete leaders to take up their responsibility in providing competence support,

will be most effective to foster the team's motivation and performance.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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