Feedback, a powerful lever in teams: A review

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ABSTRACT

This paper reviews the literature on the effects of feedback provided to teams in higher education or organizational settings. This review (59 empirical articles) showed that most of the feedback applications concerned “knowledge of results” (performance feedback). In contrast, there is a relatively small body of research using feedback conveying information regarding the way individuals or the team performed a task (process feedback). Moreover, no research compared the effectiveness of process versus performance feedback. Concerning feedback effectiveness, half of the studies implementing performance feedback research reported uniformly positive effects while the other half resulted in positive effects on some dependent variables and no effect on others. All the studies using solely process feedback showed mixed positive results: some dependent variables improved while some others did not change. None of the studies reported any negative effects. This review also highlighted 28 key factors supporting feedback interventions effectiveness.

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1. Introduction

Teams become increasingly prevalent within educational and organizational settings. A team approach to work is considered more appropriate for complex tasks that could not be handled by high-expert individuals. Indeed, collective cognitive resources are likely to outperform individuals working alone. Nowadays, in a variety of contexts, teams are asked to interact, manage, and carry out challenging tasks by pooling their knowledge and skills. Organizations have shown a shift from individual positions in delimited environments to teams described as complex, adaptive, and dynamic at all hierarchical levels (McGrath, Arrow, & Berdahl, 2000). Similarly, in educational settings, different forms of collaborative learning environments requiring peer interactions and shared effort of student teams to solve complex problems have been implemented expansively (Barron, 2000; Dillenbourg, 1999; Druskat & Kayes, 2000; Kirschner, 2009). Working in teams, however, does not automatically yield to team learning and does not ensure team performance (Roschelle & Teasley, 1995). Teams may fail to use their potential or consider teamwork time-consuming and too demanding (Dickinson & McIntyre, 1997; Rummel & Spada, 2005). Consequently, providing teams with adequate support is needed to secure teamwork. Research on team learning and performance has increased our understanding of how teams learn but is still in its development phase and in search for leverage points that can be used to trigger team learning (Decuyper, Dochy, & Van den Bossche, 2010; Edmondson, Dillon, & Roloff, 2008; Kozlowski & Ilgen, 2006). Feedback is argued to be a powerful tool to shape team learning and in turn, team performance (Kozlowski & Ilgen, 2006; Locke & Latham, 1990; London & Sessa, 2006). It has been proposed as a potent feature in any learning process and achievement (Bartram & Roe, 2008; Boud, 2000; Hattie, 1999; Hattie & Timperley, 2007) and received considerable research attention as a determinant of individual behavior (Kluger & DeNisi, 1996). Feedback can serve several purposes such as: bringing the resulting outcomes of the activity or the process into focus, providing information when people move away from initially set goals, helping in adjusting or fixing new goals, guiding activity, and promoting critical reflection on the tasks and situations to bring about new insights and approaches (Bartram & Roe, 2008). London and Sessa (2006) argued that without feedback, teams might be able to change but not to learn as they depend on feedback to monitor and regulate themselves in order to be able to complete their tasks effectively.

The present article deals with feedback interventions in teams defined as the communication of information provided by (an) external agent(s) concerning actions, events, processes, or behaviors relative to a task completion or teamwork (London, 2003; London, Polzer, & Omoregie, 2005). A large number of studies and feedback reviews have focused on the effects of feedback (Bartram & Roe, 2008), but it has mainly been delimited to performance feedback (e.g., provision of information about performance) at the individual level (Alvero, Bucklin, & Austin, 2001; London, 2003; London & Sessa, 2006). However, results of research on individual-level performance feedback cannot simply be generalized to feedback research on a team-level. Researchers have stressed the differences between the effects of feedback received by an individual considered in isolation versus feedback received in team environments (Barr & Conlon, 1994; Dewett, 2003; Nadler, 1979). This is due to the distribution of feedback among team members, which is dependent on a complex interaction of individual and unique team-level variables like the team’s interactions, communication, and individual perception of feedback (Barr & Conlon, 1994). Indeed, information provided to teams may be confounded by others’ actions and behaviors and confusing for team members. It may convey multi-level data (about themselves, the team as a whole, or both) that have to be interpreted and understood by individuals. For example, if they are given team-level information, team members have to figure out to what degree these data reflect their individual input. This interpretation might be difficult as they have a distributed impact on the total team performance and functioning (Hinsz, Tindale, & Vollrath, 1997; Nadler, 1979).

To conclude, though feedback is widely acknowledged as a valuable tool for individual learning in general, it is unclear whether teams benefit from feedback to enhance their team processes and/or their performance (Barr & Conlon, 1994; Dewett, 2003; Hinsz et al., 1997) nor is it clear what type and level of feedback is actually efficient and under which conditions (Alvero et al., 2001). Feedback provided in teams is a complex phenomenon that necessitates considering feedback as a lever dependent on a series of variables related to its implementation and context. It builds up a first step toward the understanding of what makes feedback powerful in teams. Consequently, the goal of the present review of the literature is to address...
these questions and go beyond previous reviews by (a) considering studies not only implementing performance feedback but also process feedback (e.g., information regarding the way individuals or the team performed a task), by (b) including studies focusing on team settings and providing feedback targeting the team as a whole or/and the individuals of the team, by (c) adopting an integrated perspective of teams considered as information processors performing cognitive activities (a cognitive perspective) and social entities interacting to jointly perform the task (a social perspective), and by (d) looking at feedback effect moderators that could explain the success of feedback implementations not only on teams’ performance but also on their cognitive and interpersonal processes.

2. Feedback provided in teams

A team is defined as ‘a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively to achieve specified, shared, and valued objectives’ (Morgan, Glickman, Woodward, Blaiwes, & Salas, 1986, p. 3). Providing feedback to teams consists of transferring information to teams or individual team members reflecting their actions, events, performance, processes, or behaviors. Feedback has several functions: “it guides, motivates, and reinforces effective behaviors and reduces or stops ineffective behaviors” (London, 2003, p. 1). Based on this definition, one can discern two types of feedback both included in the present review: performance and process feedback (Geister, Konradt, & Hertel, 2006; London & Sessa, 2006). Performance feedback is conceptualized as the provision of information about individual or group performance to reinforce good performance or to correct poor performance enabling improvements to be made. Process feedback is defined as information regarding the way one performed a task and reached expected results. Process feedback can tackle different parts of the process. It could bear upon task-related, interpersonal, and also cognitive aspects. Task-related process feedback consists of information about the task tackled by individuals or the team, more specifically displayed behaviors, actions, and strategies, such as “you set the objective of the meetings” (Geister et al., 2006). Interpersonal feedback describes the social conditions under which teams build their shared understanding such a message that “during this meeting, you built a positive atmosphere by listening to each other, showed a high level of acceptance and mutual respect” (Akkerman et al., 2006), whereas cognitive feedback refers to the actual cognitive interactions or the extent to which information, ideas, or cognitive processes are being shared among the group members (Hinsz et al., 1997) and are being used in a coordinated way. A message like “your team bore upon each others’ areas of expertise” consists of a cognitive feedback.

Feedback in teams may also vary according to the unit on which information is provided (Alvero et al., 2001; Geister et al., 2006; London & Sessa, 2006). It targets the team as a whole (team-level feedback), the individuals of the team (individual-level feedback), or both of them in which case team members have a representation of how the team behaves as an entity along with their individual contribution. For example, the effectiveness of health care delivery is often measured by a team-level outcome: patient satisfaction. Medical teams can be given patient-satisfaction data, meaning team-level performance feedback representing how the whole team performed with regard to the quality of care and services. This feedback does not denote each medical employee’s contribution nor does it highlight who did errors or displayed unsafe behaviors during surgeries. Conversely, each health care worker can receive individual-level feedback about his behaviors in the operating room, for example about the patient safety procedures he completed (see Appendix A). Feedback level may be confounded with the feedback setting (teams versus non-team settings). We thus rather use the term “team feedback” to depict feedback given in team settings and “individual feedback” to refer to feedback provided to individuals considered in isolation.

Feedback is applied in teams because it is believed to have an effect on their performance but also on the coordinated process through which they complete their tasks, bringing together their cognitive, affective, and behavioral resources (Bartram & Roe, 2008; Kozlowski & Ilgen, 2006). In contemporary frameworks, team effectiveness has been shown to be largely affected by team processes and emergent states (Kozlowski & Ilgen, 2006; Marks, Mathieu, & Zaccaro, 2001; Mathieu, Maynard, Rapp, & Gilson, 2008). Team processes are defined as team members’ interactions before, during, and after task completion and consist of analyzing the mission, planning, setting goals, strategizing, monitoring the task and team members, and managing conflict, confidence, affects, and team motivation (Marks et al., 2001). Emergent states are conceived as cognitive, motivational, or affective properties of the team and refer to conditions dynamically shaping effective collaboration, such as the collective belief that each member is committed to the team and the task (i.e., cohesion as an affective emergent state) and the distribution of knowledge within teams and its effective use (i.e., transactive memory systems as a cognitive emergent state) (DeChurch & Mesmer-Magnus, 2010; Mathieu et al., 2008). Beyond the most extensively considered dependent variable “performance”, we hypothesized feedback to be an agent through which central team processes and emergent states may be developed and strengthened as well. We thus looked at dependent and moderating variables hinging upon affective, cognitive, and interactional aspects of teams.

Before presenting our organizing framework on feedback in teams, we turn to previous reviews on team feedback interventions.

2.1. Results from previous reviews

Many reviews and meta-analyses have shown the well-known effects of individual feedback, mostly performance feedback (e.g., Alvero et al., 2001; Balcazar, Shupert, Daniels, Mawhinney, & Hopkins, 1989; Denson, 1981; Guzzo, Jette, & Katzell, 1985; Ilgen, Fisher, & Taylor, 1979; Kluger & DeNisi, 1996; Mento, Steel, & Karren, 1987; Neubert, 1998). However, individual
feedback literature showed that performance feedback did not always reach the expected results, even leading to decreased performance in one third of the studies, as presented by Kluger and DeNisi (1996) in their pivotal review study. To explain this result, they analyzed feedback interventions that were effective and indicated that they comprised cues directing attention on task learning processes. Overall only a few studies adopt a more comprehensive view of feedback effect and emphasize its moderators as well as feedback process. And yet, these factors may also explain some of the negative effects of feedback. For example, Ilgen et al. (1979) drew attention to several dimensions of performance feedback (its timing, sign, and frequency), its reception and acceptance (i.e., the extent to which it is perceived as accurate), and individuals’ willingness to respond to it. These findings provide some clues about conditions influencing the effectiveness of feedback interventions at the individual level. The conditions under which feedback effectiveness is optimized in teams are even less well understood.

If individual feedback research is compared to literature reviews addressing feedback given in team settings, it seems like team feedback (especially based on process data) has not yet been explored extensively. Team feedback was addressed by four previous feedback reviewers, namely Nadler (1979), Balcazar et al. (1989), Hinsz et al. (1997), and Alvero et al. (2001). Surprisingly, the latest review was carried out a decade ago, and yet, teams have become an increasingly popular focus of interest in many studies. Among these studies, Alvero et al. (2001) and Balcazar et al. (1989) embraced a performance-driven view. Nadler (1979) included both process feedback, precisely interpersonal feedback (i.e., information about how the group functions) and performance feedback, whereas Hinsz et al. (1997) adopted a process perspective and more specifically a cognitive one. In the following paragraphs, each review is described in terms of its findings on feedback level and type.

Nadler (1979) reviewed performance and process (interpersonal) feedback interventions at both levels in experimental task groups. He leaned on a model describing factors on which feedback is contingent. In particular, feedback (including feedback type and level) and team members’ characteristics, the nature of the feedback process, and the team task were regarded as key factors to examine feedback usage. First, his analysis showed that team-level feedback was more effective under two conditions: when team members displayed differentiated roles and when the task required their interdependence. Second, team-level versus individual-level feedback appeared to have a differential impact on the reviewed dependent variables. Specifically, team-level feedback gave rise to attitudes toward the team (e.g., attraction, involvement), while individual-level feedback given in a team setting improved individual performance. Third, Nadler observed that individual differences (e.g., affiliation versus task or achievement orientation) played a role in people’s response to feedback. Regarding feedback type, he concluded that performance information were more likely to produce performance changes, while interpersonal feedback might help teams be more effective if augmented with additional information, although it did lead to better team functioning. However, Nadler reported a very small amount of studies on process feedback, especially on the interpersonal aspect, and stressed the need for additional research on the difference between feedback types and how process information could be augmented. Furthermore, he highlighted the limitations of previous team-level feedback studies due to their experimental procedures. More specifically, these studies rarely compared the use of both feedback levels in separate conditions and sometimes used tasks inducing limited interdependence or communication.

Hinsz et al.’s (1997) dynamic information-processing perspective review considered how teams process and share information and how the team response to feedback might in turn modify the situation. These authors considered both levels of process (cognitive) feedback in small interacting task groups. Interestingly, they selected studies looking at cognitive aspects that could account for team performance variability in cognitive tasks (e.g., information sharedness among team members, the variability of their cognitive representations and processes). These results provide insight into reasons for differences in team performance; however, they did not investigate the explanatory power of these cognitive factors with respect to feedback interventions. In relation to feedback effectiveness, they showed that feedback about other teammates’ behaviors could influence team processes and outcomes. Concerning feedback level, they pointed out that those individuals provided with individual feedback tented to attribute good performance to themselves and failure to the situation, whereas teams given team-level feedback held their team responsible for team success. They suggested that team-level feedback might switch members’ focus from themselves to their team as well as contribute to the resolution of disagreements that could not be handled if only individual-level feedback was provided. Their analysis also revealed a differential impact of feedback type. In particular, based on the studies reviewed, they concluded that cognitive feedback should be preferred to task-related process feedback to increase learning and members’ satisfaction, although they had a similar impact on group judgment accuracy. The authors noted that some issues related to feedback effectiveness were still not well understood, such as team-level feedback effect on team processes and the balance between performance gains brought about by team-level feedback and some eventual process losses due to the high cognitive load of information required by team collaboration. Moreover, none of the reviewed study compared two conditions providing individual and team-level feedback. Hinsz et al. (1997) underlined the importance of socio-emotional aspects of team process as part of information processes and the need for additional attention on these aspects as well. Yet, they were not taken into account in their review. Additionally, they only considered cognitive tasks, neglecting other types of teams.

A more recent review including team-level feedback and updating the earlier one from Balcazar et al. (1989) was conducted by Alvero et al. (2001). They looked at performance feedback in organizations and focused on field studies, excluding all research conducted in laboratories. Each feedback application was analyzed in the light of its characteristics and combinations to identify the most consistent regarding performance improvements. They showed that feedback used in combination with other procedures (e.g., antecedents stimuli like staff training or behavioral consequences) might reach higher
performance than feedback implemented alone, (2) feedback was more consistently effective when provided by supervisors and researchers rather than by supervisors/managers alone, (3) higher performance was attained when performance feedback was verbal and accompanied by graphs, (4) the highest levels of consistency effects were achieved when feedback was both private and public, and (5) when individual members or teams could compare their team or individual performance to a standard of team or individual performance or their previous performance. Among the 43 studies reviewed, individuals were the most common recipients given feedback while teams were targeted in 14 studies. Team-level feedback was accompanied by individual-level feedback in 8 studies. The analyses showed that almost 75% of the team-level feedback applications uniformly improved performance, against 55% of the individual-level interventions. It appeared that team-level feedback was better able to lead to consistent positive effects. They confirmed the trends shown earlier by Balcazar et al. (1989) to a higher extent. However, some results should be interpreted with caution as some of them draw on a small amount of studies.

Overall, previous reviews suggest that team-level feedback might be more effective in case of task and team interdependence, with team members prone to affiliate with others, when the goal of the feedback giver is to impact attitudes towards the team, members’ attribution of performance to the team and reduce disagreement among team members. With reference to feedback type, it seems like process feedback (as defined in this review) has an effect on team functioning, learning, and members’ satisfaction while performance feedback appears to improve performance. These findings improve our understanding of feedback differential effect in teams and provide evidence of the existence of many factors that can help or impede feedback use. Nevertheless, a common definition of process feedback is lacking and there is a confusion between the different aspects it can tackle (cognitive, task or interpersonal). Process feedback referred to interpersonal information in Nadler (1979), while it consisted of cognitive data in Hinsz et al. (1997). Furthermore, all the reviewers made clear that team feedback has yet some unknown facets such as how it should be given, the characteristics it should have, and which factors enhance or mitigate its effect. In conclusion, updating earlier reviews looking at feedback in teams turns out to be needed, in particular within the context of an increase use of teams nowadays. Additionally, none of the review provided a complete overview of feedback received in team environments as they only considered one type and/or level of feedback. A more integrated review should include all feedback types and levels and systematically identify the characteristics of feedback applications that contribute to its effectiveness, as was done in some previous reviews.

Prior to analyzing empirical studies implementing feedback in teams, a theoretical consideration of how feedback affects team performance, team processes, and emergent states was needed. Such a framework might help interpret findings and identify determinants to feedback effectiveness and thus understand why feedback may not always lead to significant changes. More importantly, due to the diversity of the feedback studies, it was indispensable to look for an underlying structure in this very complex and scattered domain of research. Nadler (1979) builds on such a framework as described previ-
ously. However, although his model is an interesting view on how feedback affects team performance and team members' efforts, a model representing both levels of analyses (individual and team levels) in parallel and examining other types of outcomes and mediators besides performance may bring additional insight into what makes the difference between effective and less effective feedback interventions.

2.2. A team feedback model to organize feedback research in teams

A team feedback model was thus established to explore how specific features of feedback delivery, situations, characteristics, and perceptions of the team and team members could moderate the widely acknowledged feedback effect (Fig. 1). Such theoretical model was developed by London and Sessa (2006). They consider that feedback plays a central role in group learning and performance by helping the team regulate its actions, evaluate, and react to its environment, by supporting team development, interdependence, and shared mental models growth. They assume that characteristics of feedback (source, purpose, clarity, and valence) influence perceptions of the feedback (i.e., how the feedback is perceived by the team and its members). Perceptions of feedback are shaped by individual or group characteristics or situations (e.g., demands and goals, prior learning experiences) and are hypothesized to affect how feedback is processed, which in turn gives rise to group or individual outcomes.

First, the feedback can have different characteristics. As depicted in Fig. 1 (see also the Appendix A), based on former reviews studies, three feedback characteristics were defined beforehand to serve as clusters to the feedback literature classification, namely the feedback level (team or individual level), type (process or performance feedback), and the feedback combinations (feedback as a single input or in combination with other components). Regarding the feedback combinations, feedback was either a single component (feedback effect could be isolated) either part of a treatment, program, or training consisting of a set of components (Komaki & Goltz, 2001). This has important implications in the evaluation of the findings, as the latter can show confounding effects of the diverse components if their effect cannot be isolated.

Second, it is important to consider the characteristics with which teams are endowed and situations in which they are embedded to uncover the ones that are critical to feedback use or that might moderate the effect of feedback on certain groups. For example, teams can be assigned a goal or they may have prior learning experiences.

Third, perceptions of feedback are defined as the extent to which team members believe that feedback is important, accurate, and useful, while processing feedback concerns how the team and/or individual members process the received feedback. Indeed, if a feedback is interpreted as irrelevant and not useful for task completion or team functioning, team or team members can react to this feedback by ignoring, discounting, rejecting, and consequently not processing it. They would not use the feedback to make the desirable changes for improvement nor implement more effective and efficient strategies if they do not assign meaning to the received feedback.

Fourth, in the initial model, outcomes comprise task outcomes (task performance) as well as learning outcomes such as knowledge. We elaborated on London and Sessa (2006) to use it as a framework to analyze studies on feedback interventions in teams, in order to examine all factors shown to be related to feedback effect in the reviewed studies. We operationalized the construct “individual or team outcomes” into three groups of dependent variables on which feedback effect could be investigated: team or individual outcomes (e.g., performance, satisfaction), team processes, and emergent states (i.e., cognitive or affective states emerging from the interactions among team members), the two latest being moderator variables in team effectiveness frameworks (Mathieu et al., 2008).

Finally, we looked at one methodological criterion of the analyzed studies that may act as a moderator of the model and was not part of London & Sessa’s model: the study design (field or laboratory study). On the one hand, feedback can be easily manipulated in laboratories but may lack of a real team context that could render the feedback less meaningful for teams. On the other hand, feedback effect may be confounded with other variables at multiple-levels in real team settings. Moreover, a structural characteristic was added to the analysis; the team/task type appeared as a potential important factor to examine (Nadler, 1979). Feedback interventions included in this article concerned an extensive range of tasks such as a task classification might shed light on how a specific feedback type/level affects certain types of teams. Some teams may be less receptive to certain feedback. Devine (2002) developed a team taxonomy distinguishing knowledge work teams (endowed with tasks with a mostly intellectual nature) and those completing a physical work, physical work teams. Knowledge work teams mainly engage in thinking tasks involving mental skills, within a nonlinear work process, and develop new knowledge and information as final products (e.g., executive teams, design teams). As for physical work teams, they mainly engage in physical work, involving physical skills within a linear work process, employ existing knowledge, and come up with a concrete product/service (e.g., service teams, production teams, medical teams). All these variables and their interrelations are illustrated by Fig. 1 (see also the Appendix A).

3. Methodology

The aim of the current review is to present an integrated summary of the accumulated state of knowledge concerning the effect of feedback interventions on task performance, team processes, and emergent states in teams. To conduct our review, we first highlighted from previous reviews and theoretical articles some critical characteristics of feedback (feedback level, type, and combinations) that would serve as a first filter to categorize the reviewed studies. Second, we set a series of criteria
3.1. Criteria for relevance

All the studies eligible for the review needed to share several characteristics: they were empirical studies implementing feedback interventions to teams through a third party; they took place in higher education or organizational settings; they used a team task; they reported feedback interventions as an independent variable being a single treatment or combined with other components; they referred to feedback effects on dependent variables (Fig.1), and they explicitly reported how they measured feedback and feedback effect with minimum descriptive information about the feedback content, level, and procedure. According to our definition of a team, team members had to be dependent on each other for gathering relevant information needful for team success, share a common goal, and have their individual outcomes directly affected by team performance. Therefore we excluded all studies in which groups of people were meeting without requiring interaction or interdependence and without a clear common work task like T-groups, therapy groups. As this review focused on the effect that a teacher, manager, supervisor, counselor, or human resource manager reaches while providing feedback to teams, we excluded peer feedback, 360-degree feedback and self-initiated feedback-seeking behavior. Studies involving direct sharing of raw data between team members, feedback stemming from multiple sources or from the task itself (task-generated feedback), or natural feedback processes coming about without an external intervention were not incorporated in the review. Only studies comparing various feedback sources to feedback from an external agent were included.

3.2. Search terms and databases

The following online databases were searched: Business Source Premier; CINAHL; EconLit; ERIC; GreenFILE; The International Bibliography of the Social Sciences (IBSS); Library, Information Science & Technology Abstracts (LISTA); Philosopher's Index; PsycARTICLES; The PsycINFO; Regional Business News; SocINDEX and Psychology & Behavioral Sciences Collection. We gained access to full-text documents by means of a wide range of search terms or keywords, namely “feedback” combined with “team” or “group”; “feedback”, “group” and “group performance”; “feedback intervention”; “process feedback”; “performance feedback”; “cognitive feedback”; “interpersonal feedback”, and “social feedback”. After checking for replicates, 585 unique sources remained. In the subsequent selection phase, the abstracts of the 585 references were read to select the relevant studies based on our criteria for inclusion. The application of the criteria for inclusion reduced the relevant references to 91, among which only 59 were fully available. The remaining 32 abstracts seemed to match the criteria but were unavailable online, in libraries, or after an email has been sent to the authors. The reviewed studies were either the object of a published article or part of a dissertation. If several studies were reported in dissertations, they were counted separately. In case series of studies were conducted by the same researchers in one article, they were counted as one single study unless they could be classified in different categories of studies.

3.3. Coding

To keep an overview of the results of this large number of feedback publications, characteristics of each consulted study were encoded in a table, specifically its reference, the database and keywords used, a check of the criteria for inclusion, its setting, participants, the type, form, and level of the feedback delivered, the feedback recipient, all measured variables, the hypotheses, method, main results and limitations of the study, as well as the potential critical factors for feedback effectiveness. The critical factors represented the variables that were shown to be related to feedback effectiveness (as defined in London & Sessa, 2006). This overview allowed a double check of the study relevance. 46 articles providing insight into feedback in team settings but not responding to the criteria for inclusion were stored in a specific table.

3.4. First step in the analysis

The 59 studies included in the review were divided into categories allowing for a more accurate analysis. First, four general groups of studies were formed based on one characteristic of their feedback interventions, namely the feedback level: studies implementing individual-level feedback, the ones using team-level feedback, the ones comparing the effect of individual versus team-level feedback, and the ones providing both levels indistinctively.

Second, within these groups, feedback applications were subdivided according to the type of feedback they were providing: performance feedback alone; process feedback alone; process feedback versus performance feedback; and both types provided indistinctively. Thus, overall, 8 categories were created.

Third, within these categories, the studies were split in two groups: the studies implementing feedback alone and the studies using feedback in combination with other components.
Table 1
Team types per study setting in the research on the effect of feedback in teams.

<table>
<thead>
<tr>
<th>Experimental studies</th>
<th>Field studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge work teams</td>
<td>Physical work teams</td>
</tr>
<tr>
<td>24 studies (41%)</td>
<td>11 studies (19%)</td>
</tr>
<tr>
<td>Decision-making tasks based on simulations (n = 10)</td>
<td>Tasks involving the construction of a product (n = 2)</td>
</tr>
<tr>
<td>For example, a business or flight simulation</td>
<td>For example, a manufacturing task (production of 3 products)</td>
</tr>
<tr>
<td>Decision-making tasks based on data/reports/real cases (n = 6)</td>
<td>Tasks requiring coordination and physical and psycho-motor skills (n = 9)</td>
</tr>
<tr>
<td>For example, a consensus-based project planning or a personnel screening task</td>
<td>For example, a time interval estimation task or a perceptual speed task</td>
</tr>
<tr>
<td>Decision-making task with no external sources than the team itself (n = 3)</td>
<td>For example, an estimation task based on quantitative judgment items</td>
</tr>
<tr>
<td>For example, an estimation task based on quantitative judgment items</td>
<td></td>
</tr>
</tbody>
</table>

Notes: "+" refers to feedback studies resulting in uniformly positive effects on all the dependent variables; "-" refers to feedback studies resulting in uniformly negative effects on all the dependent variables; "NE" refers to feedback studies showing no effect on any of the dependent variables; "Mixed +" refers to feedback studies resulting in a positive effect on certain dependent variables and negative effects on some others; Mixed - refers to feedback studies resulting in a positive effect on certain dependent variables and negative effects on some others; "Mixed -": refers to feedback studies resulting in a negative effect on certain dependent variables and no effect on some others.

Table 2
Number of studies included in this review per feedback dimension and the overall effectiveness of their feedback interventions.

<table>
<thead>
<tr>
<th>Feedback level</th>
<th>Feedback intervention design</th>
<th>Type of feedback</th>
<th>Contrast of types of feedback (performance versus process feedback)</th>
<th>Combination of both types of feedback (indistinctly)</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual-level feedback</td>
<td>Single component</td>
<td>Performance feedback</td>
<td>3 studies (1 + 2 Mixed +)</td>
<td>1 study (Mixed +)</td>
<td>1 study (Mixed +)</td>
</tr>
<tr>
<td></td>
<td>Multi-component</td>
<td>Process feedback</td>
<td>1 study (Mixed +)</td>
<td>1 study (Mixed +)</td>
<td></td>
</tr>
<tr>
<td>Combination of both levels (indistictly)</td>
<td>Single component</td>
<td>Contrast of types of feedback</td>
<td>1 study (Mixed +)</td>
<td>1 study (Mixed +)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Multi-component</td>
<td>Performance feedback</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team-level feedback</td>
<td>Single component</td>
<td>Combination of both types of feedback (indistinctly)</td>
<td>3 studies (1 + 2 Mixed +)</td>
<td>1 study (Mixed +)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Multi-component</td>
<td>Performance feedback against performance feedback (+)</td>
<td>1 study (Mixed +)</td>
<td>1 study (Mixed +)</td>
<td></td>
</tr>
<tr>
<td>Contrast of levels of feedback (Individual versus team-level feedback)</td>
<td>Single component</td>
<td>Performance feedback against performance feedback</td>
<td>15 studies (7 + 8 Mixed +)</td>
<td>1 study (Mixed +)</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Multi-component</td>
<td>Mixed feedback</td>
<td>2 studies (2 Mixed +)</td>
<td>1 study (Mixed +)</td>
<td></td>
</tr>
</tbody>
</table>
3.5. Literature analysis

After clustering the selected 59 studies, a comprehensive analysis within each feedback subgroup was conducted. A first step was to look at the study design (laboratory or field study) and the team type (knowledge or physical work teams) to eventually draw conclusions on these moderators when there seemed to be different patterns of results and if enough studies allowed any comparison.

A second step has been completed to identify possible moderators of feedback effectiveness. We looked at feedback, individual or team characteristics, feedback perception and processing that were measured and/or manipulated in the reviewed studies and checked whether their impact in the relationship between feedback interventions and the measured independent variables could be highlighted.

Regarding the dependent variables that feedback was expected to influence, they were organized along three subcategories according to the conceptual model: (a) individual or team outcomes (e.g., performance), (b) team processes, (c) emergent states (subcategorized as cognitive or affective). This categorization aimed to explore whether certain types of dependent variables were more affected by a certain feedback type/level. Furthermore, as summarized in Table 2, feedback effect on measured independent variables was considered as:

- a positive feedback effect when feedback resulted in uniformly positive effects on all the dependent variables
- a negative feedback effect when feedback resulted in uniformly negative effects on all the dependent variables
- no feedback effect when the studies did not show any changes in any of the dependent variables
- a mixed positive effect when feedback resulted in a positive effect on certain dependent variables and no effect on some others
- a mixed negative effect when feedback resulted in a negative effect on certain dependent variables and no effect on some others

4. Results

The results section starts with an overview of the studies included in the review, more precisely a description of the research designs and team types covered by the studies and the distribution of the studies over the feedback-level categories. Subsequently, studies are examined in detail for every feedback level. In particular, feedback effectiveness is cross-examined and variables shown to be related to feedback effectiveness are highlighted. In each group of studies, we look at the nature of the dependent variables impacted by feedback interventions and the type of feedback associated with the effect.

4.1. Overview of the 59 studies included in the review

Most of the studies selected in the review (81%) were conducted in the United States. Regarding the time line, approximately one third of studies took place during or before the eighties, one third in the nineties and one third after 2000.

With respect to the research design of the studies, as presented in Table 1 and 60% of the feedback interventions took place in laboratories, while 40% were conducted in the field. Among these field studies, 80% studied the target variables in organizational settings, whereas only 20% examined teams of students in educational settings. Studies experimentally looking into feedback effect mainly consisted of one or more feedback treatment conditions in which participants were provided with feedback information compared to a no feedback control condition. Field studies were of different types. 7 corresponded to descriptive studies. A large group of studies compared feedback intervention(s) to (1) a no intervention group (in 4 studies), (2) a prior baseline period during which teams were not provided with any treatments (in 8 studies) or (3) a group receiving another level of feedback (in one study). Finally, 4 studies were longitudinal with repeated-measures.

Table 1 also indicates that knowledge work teams appear to be the most frequent team type used in the reviewed studies. More interestingly, when looking at the team types per study design, 68% of the teams participating to laboratories performed tasks with a primarily intellectual nature. In other words, researchers using experimental designs to manipulate feedback tended to simulate thinking tasks. Specifically, these simulated thinking tasks were mostly tasks during which teams had to make many decisions, set goals, build plans, and monitor task execution. Some studies used simulation games providing teams with very complex environments and information flow and allowing them to make decisions and observe their consequences in a safe environment. Among these, in business simulations, teams had to run virtual companies and thus address organizational issues such as the analysis of their business performance, strategic planning, and the implementation of change plans. In flight, air traffic control, or air defense simulations teams were surrounded with extensive information that they had to integrate to make many non-routine decisions in real time. Besides simulations, other studies provided teams with reports, cases, and data to simulate team-decision scenarios. The difference lies in the medium used to trigger team decision and negotiation. Other cognitive tasks not relying on decision-making were tasks requiring creativity. There is an apparent analogy with design teams conceiving new products or services, frequently named research and development teams or project teams (Devine, 2002). For example, in one study, an idea generation task in which teams had to brainstorm as many solutions as possible to a problem was used (Prussia & Kinicki, 1996). In laboratories, the remaining physical tasks were mainly tasks requiring coordination and physical and psychomotor skills. For instance, in tracking tasks, team members had to hold a moving cursor steady at zero by manipulating a control knob. Another physical-work example was observed in two feedback
interventions requiring teams to construct an object. This is typically a simulation of production teams assembling or constructing concrete products (Devine, 2002). In comparison to laboratories, field studies exhibit a less contrasted trend. Feedback interventions targeting knowledge-work were slightly more frequent than the ones involving physical-work teams. Again, among the knowledge-work teams, decision-making teams were the most frequent participants.

In educational settings, the tasks mostly required students to analyze a situation involving a decision or the resolution of a problem and to formulate recommendations. In organizational settings, the participating teams were mainly engaged in organizational-level decisions (i.e., executive teams as defined in Devine (2002) or in highly procedural special projects or inquiries entailing judgments or plans (i.e., commissions as defined in Devine (2002)). Also, design teams developing new products participated in three studies. Physical-work field teams were of three kinds: production teams, medical teams, and service teams (i.e., teams offering goods and services to customers).

Finally, Table 2 shows the number of studies within each feedback characteristic and the overall effectiveness of their feedback interventions. It provides an overview of several questions: how does team feedback research divide among all categories, what is the general trend of feedback research in teams, and what is the overall effect of feedback on various dependent variables. A first look at the distribution of the 59 studies shows three trends. First, most of the team feedback studies split into two categories both using performance feedback interventions as an isolated input: team-level performance feedback research (32% of the feedback studies) and individual versus team-level performance feedback research (a quarter of the feedback applications) comparing the effect of the two levels of feedback. More than half of the studies were hence designed in order to look into team-level feedback effect or solve the question about the superiority of one level compared to the other. Secondly, there is also a relatively small body of research about process feedback, which was used overall in 22% of the studies. If we leave aside the 8 studies using both types of feedback indiscriminately, 46 studies reported performance feedback uses against only 5 using exclusively process feedback. Most of the 13 studies providing process information to teams reported feedback as a single independent variable and were rather team-level or both-levels based than individual-level based. One last striking observation is the absence of studies comparing the use of process and performance feedback in separate conditions, whereas the studies contrasting the levels of the feedback are overrepresented. At a first glance, the question whether it is more effective to target the team as a whole or the individuals with feedback seems more extensively tackled whereas the issue concerning whether information about process or performance or both is more powerful within team contexts seems unanswered. A closer look to the effects brought about by feedback interventions is taken in the following section. The analysis is structured per level of feedback and also looks into the type of dependent variables positively related to feedback interventions as well as the possible sources of variation of the effects of feedback on these variables as depicted in the theoretical framework (see Fig. 1).

4.2. Feedback interventions analysis per feedback level

4.2.1. Individual-level feedback research in teams

The first question addressed in this section is whether individual-level information provided to individuals working in teams results in some changes. In this review, six studies investigated the effect of feedback that targets individual team members. Half of these used performance feedback as a single input. Two studies employed process feedback but only one revealed the single effect of process (cognitive) feedback. The other implemented process (interpersonal) feedback as part of an intervention. As a result, the effect of feedback could not be identified independently of the other intervention components.

4.2.2. Individual-level performance feedback studies

Performance feedback was shown to positively impact two team outcomes: group performance and job satisfaction (Hunter, 2006; Moreland & Myaskovsky, 2000). In their laboratory study, Moreland and Myaskovsky (2000) demonstrated that individual-level performance feedback enhanced group performance when compared to a no feedback group tackling the same team task (radio building), being trained to the task individually beforehand as well but receiving no information about their performance. However, the feedback condition did not diverge significantly from a team training condition. In the latter, participants learned how to complete the task together, could communicate freely during this learning phase, but did not have any indication on their performance before completing the team task. Conversely, in the feedback condition, teams were given public individual-level information about their actual radio building skills stemming from the individual learning phase before completing the team task but were not allowed to communicate. Besides, they found support for a positive influence of feedback on two emergent states: a cognitive, namely transactive memory systems (i.e., knowledge distribution within teams), and an affective one, team members’ familiarity with one another. Finally, two studies showed that performance feedback improved team processes: motivation (Kerr, Messé, Park, & Sambolec, 2005) and team members’ performance-related assertiveness behaviors (i.e., instances in which team members communicate their ideas, information, and observations in a persuasive way) (Smith-Jentsch, Salas, & Baker, 1996). For instance, in their experiment using a physical work task, Kerr et al. (2005) reached a motivation effect (i.e., “Köhler Effect”) defined as situations in which team members surpass themselves and work harder in their team than they would if they were working alone. Nevertheless, these results were limited to one condition in which individual-level feedback was public so that all team members could detect each individual contribution.
4.2.3. Individual-level process feedback studies

The effect of process feedback at the individual level has been examined in only two studies, among which feedback was not shown to be significantly related to team performance, contrary to Harmon and Rohrbaugh’s (1990) hypothesis. These are the only researchers looking at feedback as a single component. They did, however, find support for a positive effect of cognitive feedback on an individual outcome, individual learning, that is to say the improvement in individual decision-making in a cognitive task. They also observed a positive effect on two cognitive emergent states, namely group consensus and reduction in disagreement among members. In their experiment, participants were first asked to render individual predictions about the outcomes of selected horse races based upon available information in racing forms. Subsequently, they were assigned to teams made of members with conflicting judgment policies. These teams were then asked to make team consensus-based predictions. Finally, individual judgments were requested again. Feedback treatments (varying feedback sharedness) were compared to a no feedback condition. The results indicated that teams receiving cognitive feedback representing explicitly members’ differential judgment policies and which sharedness was encouraged reached more consensual decisions with which every team member could agree. They also exhibited less disagreement between team members as could been proved by (1) a higher agreement among team members’ individual post judgments, (2) a lower disagreement between post individual-level predictions and the group decision, and (3) higher subjective ratings of the group policy by team members. The other study demonstrated that interpersonal feedback could also enhance team processes, namely interdisciplinary skills, when combined with other strategies. Becker and Goodwin (2005) showed that strategies orienting students to a virtual classroom, specifically greater technical support, print-based study guide, enhanced faculty guidance to mentors, and feedback about team members’ participation, promoted greater team work skills but did not intensify the frequency of online interactions (students’ postings).

In summary, the evidence seems to indicate that individual-level performance feedback can positively impact team outcomes (performance and satisfaction) and that individual-level process feedback resulted in enhanced team processes and cognitive emergent states, but not in better performance. None of the studies established any negative feedback effect. Feedback at the individual level did indeed lead to some changes on certain variables but it is important to know under which conditions these effects came about.

4.2.4. Key factors to individual-level feedback interventions effectiveness

In relation to important variables of feedback effectiveness depicted in the team feedback framework (Fig. 1), three feedback characteristics were shown to be of importance in individual-level feedback literature; sharedness, timing, and level of publicness of feedback (see the overview in Table 3). Harmon and Rohrbaugh (1990) pointed out that teams provided with individual-level cognitive feedback that was mutually exchanged among team members increased their individual learning and team consensus compared to subjects provided with individualized feedback of which sharing was not especially encouraged or to a no feedback group. Kerr et al. (2005) found that performance feedback timing was related to a group motivation gain (“Köhler Effect”). Specifically, a delayed individual-level performance feedback reduced the group motivation gain that could be attained by an immediate feedback. Concerning feedback level of publicness, they showed that continuous feedback and monitoring of all members’ performance during the task was not necessary; the same effect was found when feedback was provided publicly at the end of the trial. However, giving no feedback or providing feedback on one another’s performance that was not identifiable to anyone eliminated any gain. This result suggests the need for both a certain level of publicness and a timely feedback to trigger team motivation.

4.3. Team-level feedback research

There is a fair amount of studies in the feedback literature in teams in which feedback depicts the team as a whole and thus examines the effect of feedback at the team level. In total thirty studies address the question of how team-level feedback affects certain outcomes, processes, or emergent states (as can be seen in Table 2). The majority of these researchers (75%) considered performance feedback and mostly as a single independent variable. One study implemented team-level process feedback and enquired into its single effects whereas three studies used both types of feedback provided simultaneously as an isolated input. Additionally two team-level process studies compared the use of process feedback along with performance feedback against performance information alone. In both studies, there was no condition providing process information only.

4.3.1. Team-level performance feedback studies

Team-level performance feedback appeared to have a positive impact on variables of diverse natures. First, there is an extensive team-level feedback literature that has incorporated team performance, the most extensively considered criterion variable, as a dependent variable. Feedback effect on performance was researched in 19 studies amongst which only 2 studies considered individual performance (Johnston, 1967; Johnston & Nawrocki, 1966), against 17 studies looking at team-level performance measures (Brannick, Prince, & Salas, 2005; Cook, 1968; Ellsworth, 1973; Henry, Strickland, Yorges, & Ladd, 1996; Hoegl & Parboteeah, 2006; Ivancevich & McMahon, 1982; Jung & Sosik, 2003; Kim & Hamner, 1976; Klaus & Glaser, 1970; Mesch, Farih, & Podsakoff, 1994; Passos & Caetano, 2005; Philo, 2004; Pritchard, Jones, Roth, Stuebing, & Ekeberg, 1988; Quigley, 2003; Scott-Young & Samson, 2006; Spoelders-Claes, 1973; Walter & Van Der Vegt, 2009). Although many researchers agree about performance feedback effectiveness, seven authors did not find much support for its expected effect on performance (Brannick et al., 2005; Ellsworth, 1973; Henry et al., 1996; Hoegl & Parboteeah, 2006; Jung & Sosik, 2003; Quigley,
For example, in a longitudinal field experiment conducted by Jung and Sosik (2003), one hundred six intact business undergraduate teams completed two complex team decision-making tasks, after which they received performance feedback. It appeared that feedback significantly influenced two affective emergent states, namely collective efficacy and group potency, but not team performance. Beyond the prominent performance outcome, two other outcomes measures were found to be impacted by performance feedback. Satisfaction was enhanced by feedback interventions in 4 studies (Hyrkas & Lehti, 2003; Kim & Hamner, 1976; Mesch et al., 1994; Pritchard et al., 1988) and organizational commitment in one study (Ivancevich, 1982).

Second, many studies have established feedback positive effect on various team processes, in particular group goal (Mesch et al., 1994; Quigley, 2003), strategy development (Quigley, 2003), coordination behaviors (Brannick et al., 2005), task and relationship conflicts (Petterson & Behfar, 2003), motivation (Ivancevich, 1982; Staw, 1975), communication and influence (Staw, 1975), and team processes defined as the extent to which team members set goals, analyzed information, monitored their environment, set and implemented strategies, and coordinated their activities (Quigley, 2003). For instance, in their longitudinal field study, Peterson and Behfar (2003) demonstrated that initial performance feedback strongly influenced subsequent team interactions. In particular, teams completing two successive case studies and given the more negative team-level performance feedback after the first task encountered the more subsequent relationship and task conflicts, which also predicted a poorer team performance at the second task. They underlined that these processes could cause and be impacted by low team performance, creating then a negative performance spiral.

Table 3
Feedback characteristics, individual and team characteristics and situations, the perception and processing of feedback shown to be effective in the reviewed studies.

<table>
<thead>
<tr>
<th>Characteristics of feedback</th>
<th>Individual situation and characteristics</th>
<th>Group situation and characteristics</th>
<th>The perception of feedback</th>
<th>The processing of feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual-level feedback research</strong></td>
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<tr>
<td>Sharpeness (Harmon &amp; Rohrbaugh, 1990)</td>
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<tr>
<td>Timing (Kerr et al., 2005)</td>
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<tr>
<td>Level of publicness (Kerr et al., 2003)</td>
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<td><strong>Team-level feedback research</strong></td>
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<tr>
<td>Valence/Scarcity (Johnston, 1967; Mesch et al., 1994; Peterson &amp; Behfar, 2003; Prussia &amp; Kinicki, 1996)</td>
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<tr>
<td>Frequency (Cook, 1968; Klaus &amp; Glaser, 1970)</td>
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<tr>
<td>Source (Ivancevich, 1982; Kim &amp; Hamner, 1976)</td>
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<tr>
<td><strong>Combination of both levels of feedback (team-level and individual-level)</strong></td>
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<tr>
<td>Timing (Hey et al., 2000)</td>
<td></td>
<td>Reinforcement and Behavioral consequences (Austin et al., 1996)</td>
<td></td>
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<tr>
<td>Frequency (Hey et al., 2000)</td>
<td></td>
<td>Specificity (Hey et al., 2000)</td>
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<tr>
<td>Constructiveness (Hey et al., 2000)</td>
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<tr>
<td><strong>Contrast of levels of feedback (Individual versus team-level feedback)</strong></td>
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<tr>
<td>Valence/sign (Berkowitz &amp; Levy, 1956; Matsui et al., 1987; Tindale et al., 1991)</td>
<td></td>
<td>Goal attainment (Matsui et al., 1987)</td>
<td></td>
<td></td>
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<tr>
<td>Frequency (Tindale, 1989)</td>
<td></td>
<td>Expectations (Sniezek et al., 1990; Tindale et al., 1991)</td>
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<tr>
<td>Distribution (major or minor; Barr &amp; Conlon, 1994)</td>
<td></td>
<td>Repression/sensitization Varca &amp; Levy (1984)</td>
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<td></td>
<td></td>
<td>Goal setting (externally and internally set: Doerr et al., 1996)</td>
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</table>

2003; Spoelders-Claes, 1973). For example, in a longitudinal field experiment conducted by Jung and Sosik (2003), one hundred six intact business undergraduate teams completed two complex team decision-making tasks, after which they received performance feedback. It appeared that feedback significantly influenced two affective emergent states, namely collective efficacy and group potency, but not team performance. Beyond the prominent performance outcome, two other outcomes measures were found to be impacted by performance feedback. Satisfaction was enhanced by feedback interventions in 4 studies (Hyrkas & Lehti, 2003; Kim & Hamner, 1976; Mesch et al., 1994; Pritchard et al., 1988) and organizational commitment in one study (Ivancevich, 1982).

Second, many studies have established feedback positive effect on various team processes, in particular group goal (Mesch et al., 1994; Quigley, 2003), strategy development (Quigley, 2003), coordination behaviors (Brannick et al., 2005), task and relationship conflicts (Petterson & Behfar, 2003), motivation (Ivancevich, 1982; Staw, 1975), communication and influence (Staw, 1975), and team processes defined as the extent to which team members set goals, analyzed information, monitored their environment, set and implemented strategies, and coordinated their activities (Quigley, 2003). For instance, in their longitudinal field study, Peterson and Behfar (2003) demonstrated that initial performance feedback strongly influenced subsequent team interactions. In particular, teams completing two successive case studies and given the more negative team-level performance feedback after the first task encountered the more subsequent relationship and task conflicts, which also predicted a poorer team performance at the second task. They underlined that these processes could cause and be impacted by low team performance, creating then a negative performance spiral.
Third, some research has considered the effect of feedback on emergent states. This body of work has primarily focused on affective emergent states and provided evidence that feedback reinforced the following team affective properties: goal commitment (Hoegl & Parboteeah, 2006), leader efficacy (Quigley, 2003), group potency (Jung & Sosik, 2003), collective or team efficacy (Jung & Sosik, 2003; Quigley, 2003; Scott-Young, 2006), cohesion (Philo, 2004; Staw, 1975), attitudes toward the task and levels of aspiration (Cook, 1968), openness to change (Staw, 1975), and group members’ perceptions of heterogeneity and outcome expectation (Jung & Sosik, 1999). For example, Scott-Young (2006) demonstrated that performance feedback was a significant predictor of team efficacy, which was associated with better performance in manager teams (knowledge work teams).

Cognitive emergent states have been a dependent variable of interest in only one experimental study. Specifically, Henry et al. (1996) showed that providing knowledge work teams talking about undemonstrable solutions with feedback rendered them better able to identify their best member, more precisely through assessing the relative quality of team members’ inputs in the discussions.

To conclude, it is noteworthy to highlight that although team-level performance feedback literature failed to significantly relate feedback use to certain variables (mostly performance) in some studies, it did not yield negative effects, except in one study. In the later, Peterson and Behfar (2003) highlighted the danger of providing initial negative feedback to teams comprising members who distrust one another.

4.3.2. Team-level process feedback studies

As presented in Table 2, the few studies looking into team-level process feedback are divided into four groups: (a) one single study investigating process feedback (Kernaghan & Cooke, 1990), (b) one study contrasting two feedback treatments; the first treatment combining process feedback with performance feedback and the other one implementing performance feedback alone (Hollenbeck, Ilgen, Lepine, Colquitt, & Hedlund, 1998), (c) one study comparing the same two feedback treatments but complementing feedback with another component (McLeod, Liker, & Lobel, 1992), and (d) three studies using both types of feedback indistinctively (Gear, Marsh, & Sargent, 1985; Prussia & Kinicki, 1996; Voelker, 2003).

First, Kernaghan and Cooke (1990) conducted the only experiment providing team-level process feedback to teams carrying out a project-planning task (knowledge work task). They found that interpersonal feedback (e.g., active listening, clarifying, supporting others’ opinions) was insufficient to improve team outcome quality as opposed to task-related process feedback (e.g., analyzing the situation, setting objectives, developing alternatives) but only when team members of the consensus groups had the ability to process it. Indeed, feedback effect was not supported for the whole sample; they only found it in high-ability groups. Moreover, they observed that providing both types of feedback did not lead to superior team performance.

Second, the study complementing process (cognitive) feedback with performance feedback suggested that it might be an effective combination in decision-making teams (knowledge work task). Hollenbeck et al. (1998) investigated the effect of feedback on the constructs of the theory of team decision-making, namely decision informaty, individual validity, and dyadic sensitivity. Decision informaty referred to the extent to which members had all information necessary to play their part in the team; individual validity was defined as members’ possibility to make recommendations predictive of the correct decision; dyadic sensitivity was the degree to which leader weighted each recommendation. The authors expected that teams receiving cognitive feedback on these core constructs would outperform teams that were only provided with performance feedback. Moreover, they assumed that the relationship between process feedback and team performance would be mediated by the aforementioned core-constructs. The results supported their hypotheses.

Third, in an experiment by McLeod et al. (1992), teams carrying out two consensual decision-making tasks were given a midpoint feedback about their interpersonal behaviors and their performance as well as an explicit discussion time during which they were asked to set a goal for the second task. They were compared to teams provided with performance feedback and given time for an unstructured discussion. Interpersonal behaviors consisted of the evaluation of the dominance behaviors (whether displayed behaviors were dominant or submissive) and the group orientedness (whether the displayed behaviors were oriented to the task or to socioemotional aspects). The results indicated that interpersonal feedback along with performance feedback and goal setting reduced the dominance behaviors of the team members but did not improve performance. These dominant behaviors were hypothesized to be detrimental to teams as they could drive other teammates to behave submissively in response and thus avoid speaking up in their teams.

Fourth, none of the studies providing teams with process along with performance feedback highlighted any significant effect of process feedback on performance. Prussia and Kinicki (1996) and Voelker (2003) tested this relationship in their respective studies, the first one with task-related process feedback, and the other one with interpersonal feedback on cooperation in the team, but both failed to find significant performance changes. Rather, this group of studies demonstrated that process feedback could enhance team processes, namely team behaviors such as making suggestions, asking directions, or giving support (Gear et al., 1985) and cooperation (Voelker, 2003), as well as three affective emergent states, group affective evaluations, collective efficacy (Prussia & Kinicki, 1996), and perceived strategy effectiveness (Voelker, 2003). For example, Prussia and Kinicki (1996) did not find a direct path between feedback and group effectiveness in teams completing a knowledge work task but proved that this relationship was mediated by group affective evaluations (i.e., team satisfaction regarding their output quantity and their process behaviors) and collective efficacy (i.e., evaluation of the team ability to achieve a particular situation).
In summary, the few studies looking into team-level process feedback seem to produce positive but still mitigated results. Three authors out of five failed to associate team-level process feedback with performance (McLeod et al., 1992; Prussia and Kinicki, 1996; Voelker, 2003) but all did find support for positive changes in terms of team processes and emergent states. With respect to feedback type, it seems like interpersonal feedback about teams’ social aspects used in four studies (Gear et al., 1985; Kernaghan & Cooke, 1990; McLeod et al., 1992; Voelker, 2003) lack the power to directly influence performance while having a consistent impact on other process variables. Indeed, this is in line with the traditional assumption that interpersonal feedback supports task completion by enhancing interpersonal processes (Dominick, Reilly, & McGourty, 1997; McLeod et al., 1992), which in turn enhance team performance (Hackman, 1987; McGrath, 1991). On the contrary, in a decision-making task, a team-level cognitive feedback may improve the decision-making performance if combined with outcome information. With regard to task-related process feedback, two studies obtained contradicting results. Prussia and Kinicki (1996) did not find any direct path between task-related process feedback and performance whereas Kernaghan and Cooke (1990) could highlight this relationship with high ability team members. This process feedback research is interesting and encouraging, although there is a need for clear conceptual definitions of the processes that a feedback can describe. In addition, in comparison to team-level performance feedback, team-level process feedback has been examined scarcely, so that any decisive conclusion cannot be given as yet. Similarly, the question of whether the effectiveness of performance feedback can be increased when it is paired with process feedback still needs to be documented.

4.3.3. Key factors to team-level feedback interventions effectiveness

Looking into determinants of team-level feedback effect is a step toward a better understanding of how feedback proceeds. Eleven important variables to feedback effectiveness were highlighted in these team-level studies (as summarized in Table 3). Three variables all based on performance feedback research pertained to feedback characteristics: frequency (n = 2), valence (n = 4) and feedback source (n = 2).

Feedback frequency was shown to positively influence performance, attitudes towards the task, level of aspiration (Cook, 1968), and team proficiency (Klaus & Glaser, 1970). Both studies provided support for the use of frequent feedback.

Regarding feedback valence, four studies supported its effect on individual performance, self-evaluation of the performance (Johnston, 1967), group performance (Mesch et al., 1994), group affective evaluations, collective efficacy (Prussia & Kinicki, 1996), relationship and task conflicts (Peterson & Behfar, 2003), group goals, group satisfaction with performance, and group strategies (Mesch et al., 1994). There seems to be convergence among researchers concerning positive feedback, which acted as a reinforcer of the before-mentioned variables. There is less agreement on the effect of negative feedback. On the one hand, Peterson and Behfar (2003) showed that negative team-level performance feedback produced subsequent higher relationship and task conflicts. These results suggest that informing teams at an early stage they performed below average could be detrimental to their subsequent relationships, especially for those teams with low initial intragroup trust. On the other hand, Mesch et al. (1994) came to the conclusion that negative feedback could be a trigger. In their laboratory study, although teams provided with negative performance feedback were less satisfied, they had higher group performance, group goals, and strategy development than positive feedback groups.

The question of the feedback source effect was addressed in two studies exhibiting contradicting results. Kim and Hamner (1976) conducted a field study in which service teams received either extrinsic (supervisory) feedback, either intrinsic (self-generated) feedback, or both paired with goal setting. Self-generated feedback stemmed from team members’ rating of the service quality and was kept private. Extrinsic feedback and praise (i.e., congratulations for good performance) was given to the teams by a supervisor and relied on goals teams were regularly setting for the work week. These conditions were compared to a goal setting only condition, in which teams were only asked to define their goals. It was found that feedback outperformed goal setting implemented alone, that the highest enhancement on two performance measures (cost and safety) was observed for groups receiving feedback from both sources, praise, and goal setting opportunity but that extrinsic feedback was better at improving service. Satisfaction was enhanced in all the conditions except in the intrinsic feedback group. Conversely, in a field study with design teams, Ivancevich (1982) compared extrinsic feedback, self-generated feedback, and feedback from co-workers to a no feedback condition. The results demonstrated that goal setting groups with self-generated feedback outperformed supervisory feedback teams and those receiving co-workers feedback on two team performance measures, satisfaction and commitment. However no condition with intrinsic feedback alone was implemented so that feedback source and goal setting effects were both accountable for the performance changes.

Eight factors were team or individual situation and characteristics: two were individual-related (individual proficiency and positive mood) and the others were team-related: team structure, task structure, team goal setting (n = 4), strategizing, a “high performance” belief, and previous intragroup trust. Most empirical work on team-level feedback has thus focused on team-level variables.

In a series of experimental studies conducted by Klaus and Glaser (1970), team performance was shaped by individual proficiency (i.e., individual ability measured at the experimental task) as well as the structure of the team and of the physical work task. In particular, they showed that having redundant members performing simultaneously the same subtasks or occupying the same position and using tasks requiring minimal interdependence among team members were detrimental to team performance. Differently stated, tasks structured so that team members had to collaborate in an interdependent manner and coordinate their actions resulted in performance improvements.

Four studies showed that a combination of goal setting and performance feedback led to higher performance (Ivancevich, 1982; Kim & Hamner, 1976; Pritchard et al., 1988) and that interpersonal feedback along with goal setting changed team
members’ dominant behaviors (McLeod et al., 1992). For example, Pritchard et al. (1988) conducted a field study in an Air Force base in which they implemented a team-level performance feedback, goal setting, and incentive system. A baseline was first established during which no feedback was given, followed by a period of feedback delivery to each unit, after which goal setting and then incentives were added. They observed an increase of productivity of 50% over baseline for feedback, 75% over baseline for group goal setting, and 76% over baseline for group incentives.

Besides setting team goals to strive for, it was shown that formulating team strategies to make changes and improvements could also facilitate team functioning and performance. Philo (2004) indicated that time spent on strategizing, more precisely collectively discussing the ways to react to negative performance feedback and achieve improvements during a team feedback meeting, was positively related to an affective emergent state, namely team members’ shared commitment to the team (i.e., team cohesion) and a performance measure, team membership stability over time (i.e., team viability).

Two group characteristics were also found to be influential. The extent to which team members believed they were in an effective team had an impact on how they perceived their group processes (e.g., cohesiveness, openness to new ideas, communication) in a study carried out by Staw (1975). In particular, teams believing they were high performing evaluated their team processes better than teams believing they were low-achievers. Additionally, Peterson and Behfar (2003) showed that groups not trusting each other before receiving a negative feedback were at risk to ongoing relationship conflicts and poor performance. These results support the effect of previous process experiences on upcoming interactions.

Finally, one factor referred to the role of perception of the team feedback. Walter and Van der Vegt (2009) demonstrated that feedback perception moderated the relation between team members’ positive mood and the degree to which team members engaged in team learning behaviors (i.e., team learning facilitation). Positive mood only promoted team learning facilitation when the well-being individuals perceived they had been provided with team-level performance feedback to a high extent.

In sum, team-level feedback literature provided insight into potential facilitators of feedback effect. It was proven that feedback that was frequent, positive, shared, and available to all team members helped teams perform or function better. Second, team members having interdependent roles, setting team goals, given incentives, reflecting upon possible strategies to achieve these goals, trusting each other, and believing they performed well appeared better able to achieve some changes. Finally, well-being individuals seemed to engage more in team learning behaviors.

### 4.4. Combination of both levels of feedback (team-level and individual-level)

Four researchers provided teams with information about the team as a whole along with information allowing team members to detect their own contribution through individual-level inputs. One study looked at performance feedback combined with another component; one used process feedback as a single component, and finally, two studies provided both feedback types and levels, one implementing feedback as a single component, the other using it as part of a training. As individual and team-level feedback were provided indistinctly, these studies do not allow for a conclusion concerning the most effective level on which feedback should be given but show how valuable the combined use of both levels can be.

#### 4.4.1. Individual and team-level performance feedback study

Austin, Kessler, Riccobono, and Bailey (1996) evidenced that individual and team-level performance feedback along with various possible behavioral consequences (monetary reinforcement or time off) increased two team outcomes in a production team: productivity and safety performance (i.e., the use of safety behaviors).

In one study, cognitive feedback was shown to improve a cognitive aspect of decision-making behavior: the degree to which team members or the team control(s) the execution of their or its decision strategy, which is hypothesized to help teams learn new decision strategies. In a decision-making experiment, Sengupta and Te’eni (1993) demonstrated that information about members’ decision strategy and its execution had a positive effect on the level of cognitive control over the decision-making process but no significant effect on the degree of similarity amongst team members’ decision strategies (i.e., strategy convergence) compared to no feedback group.

In a case study, Sivunen (2006) demonstrated that performance and process (interpersonal) feedback given at both levels indistinctly improved an affective emergent state: members’ identification with the team.

Finally, in a survey study conducted by Hey, Pietruschka, Bungard, and Joens (2000), 357 team workers from service and production teams rated the overall effectiveness of individual and team-level feedback they were receiving in their respective companies as low, only a part of it being perceived as leading to higher performance or cooperation. They also stated that team feedback was not regular, was not given immediately after a certain performance or behavior, and was not received directly nor it was specific enough.

#### 4.4.2. Key factors to team-level feedback interventions effectiveness

There are four feedback characteristics presented as relevant for its effectiveness in Hey et al. (2000): feedback timing, frequency, specificity, and constructiveness. These were provided to the team respondents as criteria to rate feedback received at their workplace and were evaluated as insufficiently met in their respective companies.

Only one study investigated the effect of a team situation and characteristic related to feedback effect. As described earlier, Austin et al. (1996) found that behavioral consequences (monetary reinforcement or time off) were associated with performance improvements.
4.5. Team-level feedback versus individual-level feedback

The studies reviewed so far focused on one feedback level or both simultaneously. Next to these, a range of studies examined feedback level as a potential source of variation of feedback effect and tested if the extent to which feedback targeted the team as a whole, team members, or both brought about changes. The question about the appropriate level of feedback to be provided in teams has been the central issue of 19 studies in total. Again most of the studies contrasted the use of performance feedback at both levels and looked into its single effect.

At a first glance, one may perceive conflicting and somewhat inconclusive results between four groups of studies in disagreement about the level(s) of feedback found to be more effective. In this section, the studies are grouped according to their findings on the more efficient feedback level they identified. That implies that feedback effect is examined per group of studies lending support to the same conclusion.

First, five studies evidenced the effectiveness of team-level performance feedback over individual-level feedback. Positive effects were found on a team outcome, namely team performance, in three studies (Doerr, Mitchell, Klastorin, & Brown, 1996; Goltz, Citera, Jensen, Favero, & Komaki, 1989; Tindale, 1989). Additionally, they demonstrated that it enhanced three team processes, namely task motivation, effort, and persistence intentions (Barr & Conlon, 1994; Doerr et al., 1996), and one affective emergent state, namely pride in group performance (Berkowitz & Levy, 1956). These studies involved either experimental decision-making teams or existing production teams completing a team product. For example, Barr and Conlon (1994) looked at the effect of feedback as a single component, manipulated the feedback sign given to individuals and to the teams (positive or negative), and the distribution of individual feedback received by team members (majority positive or majority negative) in a business decision-making simulation. They confirmed their hypothesized main effect of team-level feedback on individual persistence intentions (i.e., self-rating of the probability to persist in a newly introduced behavior). Furthermore, groups provided with positive team-level feedback displayed higher intentions to continue the new behavior than groups receiving negative feedback. They also showed that individual-level feedback had an effect on persistence intentions only when the received feedback was negative. Finally, they established that team members provided with a majority feedback, which is an individual feedback that does not differ from those received by group members, displayed more persistence intentions, than those receiving a minority feedback. For example, when an individual member gets a positive feedback and the other team members receive a positive feedback as well, he will keep on displaying his behavior more than if he has been provided with a negative feedback.

Secondly, alternatively, some researchers contended that team members might be confused by ambiguous team-level inputs not conveying any diagnostic information on how they could improve their own individual behaviors driving team performance. Three studies demonstrated that providing both individual and team-level performance feedback affected team performance more than individual or team-level feedback provided alone (Matsui, Kakuyama, & Onglatco, 1987; Rosenberg & Hall, 1958; Zander & Wolfe, 1964). These were laboratory studies all employing tasks requiring physical and psycho-motor skills. For instance, Matsui et al. (1987) investigated the effect of feedback and goal attainment using a perceptual speed task. Teams were asked to set individual and team goals and were given feedback concerning their goal attainment. More specifically, they were told they were above or below the previously specified target. They found interaction effects of both levels of feedback, meaning that individual and team-level feedback were complementary and could maximize feedback effectiveness. They supported that if team members were not given individual-level information, those below target with respect to their individual performance would not enhance it in the case their team performance was meeting their team goal. Conversely, with no team-level feedback delivery, those subjects whose team was not on course to meet their target goal. Furthermore, groups provided with positive team-level feedback displayed higher intentions to continue the new behavior than groups receiving negative feedback. They also showed that team members provided with a majority feedback, which is an individual feedback that does not differ from those received by group members, displayed more persistence intentions, than those receiving a minority feedback. For example, when an individual member gets a positive feedback and the other team members receive a positive feedback as well, he will keep on displaying his behavior more than if he has been provided with a negative feedback.

Thirdly, yet one may argue that team members may be overwhelmed by multiple-level data provided continuously and thus fail to carry out effectively their team tasks. Four studies demonstrated the superiority of individual-level performance feedback compared to team-level feedback on performance (Burgio, Engel, Hawkins, McCormick, & Scheve, 1990; Burnstein & Wolff, 1964; Stone, 1971). For example, in a field study, Burgio et al. (1990) observed that after team-level performance feedback was introduced to medical teams, their performance showed an improvement that declined gradually after several months. When individual-level feedback data were provided, team performance recovered. However, these results did not control for sequence effects as both levels of feedback were given sequentially to the same people. Additionally, in one study by Smith (1972), individual-level process (interpersonal) feedback produced more changes in participation, an interaction process, than team-level feedback. Overall, this group of studies did not converge on the team type they used.

Fourth, two studies showed no effect of feedback level. Roberts (2000) did not find any association between performance feedback levels and performance. Sniezek, May, and Sawyer (1990) conducted the only study contrasting feedback levels and types (both types versus performance feedback) and compared these conditions to a no feedback condition and a condition under which members expressed their expectations about each other’s commitment. In their experimental setting, they created a conflict between individual and team interests through the rewarding system of a resource allocation task and provided feedback about the team or individuals’ contribution to the team task (cognitive feedback) and the individual or group outcome amount (performance feedback). Significant increased resource allocations to the group were observed in groups receiving cognitive feedback, specifically if that feedback was at the individual-level over team-level feedback. However, the effect of feedback level no longer existed when team members expressed their expectations about other members’ future contribution to the group. This study suggested that cooperation and greater concern for team outcomes was increased by knowledge of members’ contributions to the group whether this information was provided or self-generated.
4.5.1. Key factors to team and individual-level feedback interventions effectiveness

Although these four groups of studies were not in agreement with reference to which feedback level they found more effective than the other, it is worth exploring possible moderators of their findings so far. A plausible hypothesis would be that team type might play a role. For example, in the first group of studies providing support for the stronger effect of team-level feedback, all studies took place in teams whose performance was depicted on a team-level, whether they were production teams interdependently contributing to a final team product or decision-making teams confronted with team decisions to be made. Conversely, studies in which individual-level feedback was proved to be more influential converged on the team task they used (task requiring physical and psycho-motor skills). This naturally puts forward the hypothesis that the decision of which feedback level to use may depend on the specific task or team type on which changes are expected.

This premise introduces the last group of studies: those explicitly looking at a differential answer to the question of whether it is more effective to target the team, the individuals, or both with feedback.

Unlike the previous four groups of studies looking for a uniform answer to this question, this fifth group of five studies would answer that the effect of feedback level may depend on certain characteristics of the people involved or on certain team or individual situations in which teams are embedded. This underlies the assumption that feedback levels may have a differential impact on certain variables. These studies provide for a more comprehensive analysis of the influential variables in feedback effectiveness. All five studies involved knowledge work teams, mostly decision-making teams. DeShon, Kozlowski, Schmidt, Milner, and Wiechmann (2004) embraced a goal-oriented view of feedback delivery taking into account the level of the goals on which to focus during a task. Team members engaged in a simulated radar task and provided solely with individual-level performance feedback directed their effort on individual performance and thus displayed the highest individual performance. In contrast, members given team-level performance feedback would focus on the team performance, yielding to the highest team performance. Providing both levels of feedback did not allow for an optimal capitalization of feedback information. Varca and Levy (1984) examined how individual characteristics, namely repression (i.e., the tendency to avoid the threat) and sensitization (i.e., the tendency to approach the threat) moderate the effect of negative feedback in a design team simulation. They observed differential attitudes (attraction to the group, task interest, attributions) in the individual and team sessions according to the team members’ characteristics. For example, sensitizers’ task interest and team attraction was higher in the individual-level feedback session than repressors’ but attributed more their team performance to ability or effort in the team-level feedback sessions. Zander and Wolfe (1964) found a differential pattern of performance feedback level in their experimental study simulating coordinating committees. In the team-level feedback condition, team members provided more information and rewards to others, displayed a higher motivation to get a good personal score and a higher trust in others. In the individual condition, teams showed more disinterest in collaboration, less wish to achieve a good score, less trust, and more strain in interpersonal relations. In contrast, in the condition providing both levels of feedback, teams reached the higher improvement in personal scores and an increase of negotiation. Tindale, Kulik, and Scott (1991) also emphasized an independent impact of both feedback levels. They conducted an experiment in which participants taking part in a consensus-based team decision-making task were given individual and team-level bogus performance feedback. They showed that both could impact individual performance. However, an improved individual performance did not automatically enhance team performance. Moreover, individual-level feedback influenced team responses to the task, while team-level feedback appeared to have a greater effect on reactions to the other team members. They also highlighted the mediation role of expectations of future performance on the effect of both feedback levels on individual performance. Finally, Bailey and Thompson (2000) detected an interesting pattern in their experiment in which teams were tackling simulated radar-based Air Traffic Control tasks under different aircraft densities (simulating workload). Groups given team-level performance feedback exhibited greater team cohesion and team performance under low aircraft density (lower workload). These improvements decreased when aircraft density increased. In contrast, more complete shared mental models were observed in the high-density conditions irrespective of the level of the feedback received.

If we analyze these studies in the light of our main question of which feedback level to use, this fifth group of studies highlights that beyond the effect of feedback level, it seems like other individual or team characteristics (team workload, goal setting, teams’ expectations, repression and sensitization traits, and team type/task) interact to produce changes. It is in line with our model of potential moderators of feedback effect (Fig. 1). These variables stemming from the fifth group of studies can be complemented by the ones shown to be of importance by the authors contrasting the levels of feedback in the other four groups of studies. Overall, they pointed out nine variables (as summarized in Table 3).

Three variables concerned feedback characteristics: the valence, frequency, and distribution of the feedback. Positive or favorable feedback (depicting high performance) was found to be linked to pride in group performance and task motivation (Berkowitz & Levy, 1956), individual performance (Tindale et al., 1991), and positive ratings of other group members and task interest (Tindale et al., 1991). Tindale (1989) demonstrated that frequent performance feedback (after each decision) improved decision performance. Finally, Barr and Conlon (1994) showed that a majority feedback augmented the persistence intentions, compared to a minority feedback.

Six team-level characteristics or situations were also identified: team workload, organization, goal attainment, goal setting, expectations, and rewards. Stone (1971) observed that project teams given performance feedback improved their performance and displayed a higher satisfaction than team organized by specialization. As for Doerr et al. (1996), interdependent tasks brought about higher levels of effort and productivity although more idle time than independent tasks. Matsui et al. (1987) demonstrated that individual and team-level feedback effect on performance was significant for groups below target whereas subjects on target sustained their previous level of performance. These results thus also support negative feedback...
as an incentive to reach set goals. Team goal setting also appeared to be a significant factor along with rewards in Doerr et al. (1996) research. Finally, expectations seem to play a role. Tindale et al. (1991) showed that team members’ perception of how well they and their team would complete a comparable task in the future was playing a mediational role. Additionally, Snizek et al. (1990) brought about interesting results in their experimental study showing the effect of stating expectations about other members’ future contributions. They observed an increase of cooperation with information about other members’ contributions to the group whether this information was provided or self-generated.

5. Conclusion and discussion

In the present review, we examined feedback as a potential “lever” that could regulate team processes and cognitive and affective emergent states and enhance team effectiveness (Kozlowski & Ilgen, 2006). Previous reviews addressing feedback in teams brought out several research gaps. Although feedback had a substantial research foundation, some feedback research areas were shown to be limited such as team-level feedback, process feedback, and team-level feedback effect on team cognitive and social variables. This review considered these and started from a framework describing variables that could potentially influence feedback effectiveness and relating feedback to dependent variables of diverse natures. We aimed to gain a deeper understanding of how feedback proceeds in teams and to identify the moderators that might explain why feedback did not always lead to expected changes. Following conclusions can be drawn.

First, the present review showed a similar pattern than previous reviews: process feedback has been far less studied than performance feedback. Research at the team process level seems still in its infancy. The two most frequent areas of feedback research in teams were: studies looking at team-level performance feedback and those comparing the effect of individual versus team-level performance feedback. This trend is clearly shown in Table 2. Studies contrasting different feedback levels were indeed more frequently published than previously. It seems that researchers increasingly recognize the potential interest of providing teams with feedback at different levels, yet none of them compared or contrasted different types of feedback.

Second, with respect to feedback overall effectiveness, while previous evidence seemed to indicate that feedback may have negative effects (e.g., Kluger & DeNisi, 1996), only one study reported a decrease in the dependent variable. Moreover, only two studies showed no feedback effect on any of the dependent variables. As Table 2 showed, performance feedback research covered 23 studies reporting uniformly positive effects and 21 studies resulting in positive effects on some dependent variables and no effect on others (mixed positive effects). In contrast, every single study implementing exclusively process feedback showed mixed positive results: some dependent variables increased while some others did not change. No study revealed any negative effect. Concerning studies contrasting feedback levels, their results have been mixed in 12 studies (among 19), but several (i.e., 7 studies) reported some consistent positive effects on all the dependent variables. In summary, feedback research in the context of teams showed mixed positive results. On the one hand, it was demonstrated in many studies that feedback might impact a huge diversity of critical team processes (amongst which the three most frequent variables: motivation, team goal, and collaboration/cooperation) and emergent states (among which the most frequent variables: collective efficacy, cohesion, outcome expectations, and task concern/interest) and occasionally have a direct effect on team performance (in 23 studies overall). On the other hand, some studies confirmed that feedback might not always lead to significant or at least measurable changes and thus not fulfill its function as a leverage point that can be used to support teams.

However, the studies analyzed uncovered patterns that transcended the straightforward question of whether feedback interventions are effective in teams. It seems that the key question was rather under which conditions improvements occur. To answer this question, we leaned on a framework depicting how feedback proceeds in teams. As summarized in Table 3, we used this model to highlight key factors that might enhance and support feedback effectiveness. Having established feedback potential positive effect, we identified nine feedback characteristics (established in 15 studies), eleven group situations and characteristics, seven individual characteristics and situations, only one variable related to feedback reception, and none to feedback processing. In practical terms, it appears that feedback intervention effectiveness might be improved if feedback is accurate, given in a timely manner, regular, non-threatening, shared, given directly to teams it targets, and when its distribution is fairly equal. Concerning feedback sign, positive feedback was generally shown to be positively linked to performance and team process variables. However, despite its potential detrimental effect on members’ affective reactions, unfavorable feedback does not always bring negative outcomes, as shown by Matsui et al. (1987) and Mesch et al. (1994): it may produce some motivational positive effects. The role of the feedback source was still unclear, with a study supporting the effectiveness of feedback from the task itself over feedback from an external supervisor and another showing the effect of both sources. Another possible source of variation of feedback related to the feedback data lies in its level and type. Regarding the type, it seems as if process feedback is more effective in driving team processes, while performance feedback may also trigger performance. However, it appears that the types of process depicted in the feedback may show a different pattern. One study associated cognitive feedback and performance, although this relationship is as yet unclear and needs additional research. Furthermore, studies showing how performance feedback can be augmented were overrepresented, whereas very few studies looked at whether process feedback may be more effective if augmented in a particular way. Indeed, there is insufficient knowledge on how to optimize the effect of process information, in particular of the three aspects it can cover (interpersonal, task-related, or cognitive).

As far as team or individual situation and characteristics were concerned, it was shown that teams with no redundant members and no overlaps in task completion, project teams, teams setting goals and strategies, given incentives and rewards, provided with information concerning their goal attainment, believing they were high performing, with no
unsolved intragroup conflicts, and with a flexible workload were likely to show improvements. Furthermore, feedback to high-ability individuals, in a positive mood given individual incentives, rewards and reinforcements and having the opportunity to set individuals goals and expectations is also like to be more powerful. Finally, team type may be of importance to decide which type and level of feedback to provide to teams. The role of this factor emerged in the group of studies contrasting feedback levels. All studies prescribing both individual and team-level feedback occurred in physical-work teams. It may be that these teams engaged in a linear work process can benefit from team-level performance information while having access to their individual contribution as well. In contrast, knowledge work teams engaged in a less linear work flow and whose final product is intangible may need more flexible patterns of feedback interventions, or one level over the other, depending on their need for interactions. All the studies showing that the appropriate level of feedback depends on some characteristics of the situation or the team members did base their assumptions on knowledge-based teams. Although no definite conclusion can be given as yet about the role of team type, as mentioned, some interesting patterns can be discerned. These observations are promising and should be explored by both laboratory and field studies varying the team types engaged in physical and knowledge work to come up with specific factors that might mitigate feedback effectiveness in each team type.

Finally, the only study providing support for the importance of feedback perception showed positive results (Walter & Van der Vegt, 2009). Clearly, a great deal of work remains to be done on the effect of how feedback is perceived and processed. How teams process feedback they receive has been neglected and appears to be a black box that has yet to be understood. A question that still deserves further investigation is what are the processes occurring between feedback reception, feedback acceptance, and the eventual subsequent changes. If teams do not assign meaning to the received feedback and do not consider it as relevant, important, and useful for their practice, they probably would not implement any changes. Conversely, teams valuing feedback they received are more likely to modify their strategies and behaviors. Team learning behaviors could be a reflection of how the feedback is dealt with. These are knowledge sharing behaviors during which the team builds meaning and reaches a common understanding. They could then be the mean by which teams collectively try to make sense of the received feedback and eventually decide to act accordingly. Qualitative data would be useful to grasp the complexity of feedback in teams, especially on how the feedback is used, acted, and reflected upon by the team and team members.

Kozlowski and Ilgen (2006), in their review of work group and team effectiveness, called attention to feedback as a potent key leverage point and stated that it was a promising topic of research in the search for team effectiveness, but yet to be extended. Our results corroborate their conclusion: feedback has multiple facets and its effect may be enhanced in so many different ways. To most effectively implement feedback interventions, we must understand why feedback modifies behavior. Future research should adopt a more dynamic and integrative view of teams. It should be integrative for two reasons. First, teams provided with feedback are embedded in a context and shaped by team (members) characteristics, actions, interactions, and boundaries. Consequently, it is important to bring together all the important variables that might contribute to its effectiveness and to look at the whole picture to better identify the underlying mechanisms that explain any contingencies in the link between feedback and team performance. Second, integrating insight from various perspectives (e.g., social and cognitive perspectives) is needed to better understand all the facets of a team. To be able to perform cognitive tasks, in other words to think, create, solve problems, make decisions, and plan some changes, a team needs to be able to communicate and interact. Future research should also embrace a dynamic point of view as team situations and characteristics as well as team dynamics may change over time thus driving changes in team processes and performance. This could be done by conducting longitudinal studies with repeated-measures at different stages of team development. For example, it might be that certain feedback types and characteristics play a more prominent role at the beginning of a team experience when the team is formed and still needs to discover team requirements, challenges, and opportunities, while being less powerful at a later stage. The great challenge will be to come up with new dynamic conceptual frameworks tailored to each team type and development time to achieve a more elaborate understanding of what makes a feedback intervention powerful.

Further work is also needed on cognitive variables. Work to date has focused predominantly on affective emergent states and less on cognitive properties of the team. Furthermore, little is known about the effect of team cognition on feedback effect, reception, acceptance, and effective use. The cognitive aspect of feedback is yet insufficiently understood and documented, so are the other aspects a process feedback can tackle (interpersonal and task-related). And yet this is a promising strand of feedback research as teams are omnipresent and raise specific cognitive and social processes that come into play in team performance.

6. Practical implications

This review study provides organizations and teachers with insights and tools to support their teams. It highlighted that feedback is indeed a potent key practice in which organizations should allocate resources: both trainings and on-the-job interventions should be tailored to the team situations and characteristics to support life-long learning. In educational settings, teachers should continuously observe their students when engaged in a team task so that they can provide them with timely feedback that could help teams optimize their teamwork. Usually, teams receive a team grade at the end of their assignment and are not monitored during the process when they may benefit and learn most from it to make improvements.

Moreover, besides performance feedback effectiveness, the present review demonstrated that process feedback interventions could influence important interaction processes and team properties that facilitate learning and performance. In order for a team to function effectively, it is essential for its members to improve their team skills and communication. These team
skills necessitate different feedback interventions conveying information about how teams communicate, interact, establish the team atmosphere, define their team objectives, monitor their performance, or coordinate in an efficient way. Process feedback helps team members identify specific areas for improvement and ways to improve. For example, teams displaying problems of communication or irrelevant strategies may lack information about what and how to improve or may not be aware of their behaviors. Since feedback has so many facets and can be augmented in various ways, teachers, managers, and trainers should first pay attention to the team setting, context, and characteristics, observe and monitor their teams on a regular basis to develop relevant team interventions that facilitate and reinforce positive team behaviors and in turn, performance. Moreover, implementing a feedback intervention acts as a prescriptive reference against which teams can evaluate their own behaviors. It helps them understand what is meant by effective (team)work in their specific setting and provide them with an opportunity to learn.

Appendix A. Key categories in the research on the effect of feedback in teams.

<table>
<thead>
<tr>
<th>Factors influencing feedback effect</th>
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<tbody>
<tr>
<td>(1) Characteristics of the feedback</td>
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<tr>
<td>Type of feedback</td>
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<tr>
<td>1. Performance feedback</td>
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<tr>
<td>2. Process feedback</td>
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<tr>
<td>2.1. Interpersonal feedback</td>
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<tr>
<td>2.2. Cognitive feedback</td>
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<tr>
<td>2.3. Task-related process feedback</td>
</tr>
<tr>
<td>Level of the feedback:</td>
</tr>
</tbody>
</table>
| 1. Individual-level feedback | To the anesthesiologist: "you reacted quickly when the patient showed changes in his heart rate and blood pressure"
| 2. Team-level feedback | To the whole team: "today you saved a patient with a severe heart injury" |
| Feedback combination | |
| 1. Feedback as an isolated component | |
| 2. Feedback in combination with other components | |
| (2) Type of dependent variables the feedback interventions targeted | |
| 1. Team or individual outcomes | |
| 2. Emergent states (cognitive or affective) | |
| 3. Team processes | |
| (3) Individual or team situation and characteristics | |
| (4) Perception of feedback | |
| (5) Processing feedback | |
| (6) The study design | |
| 1. Laboratory study | |
| 2. Field study | |
| (7) The team type | |
| 1. Knowledge work teams | |
| 2. Physical work teams | |

References

References marked with an asterisk indicate studies included in the review


