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## Let's be frank: Individual and team-level predictors of improvement in student teamwork effectiveness following peer-evaluation feedback

Antoaneta P. Petkova<sup>a</sup>, Monique A. Domingo<sup>b</sup>, Eric Lamm<sup>a,\*</sup>

<sup>a</sup> San Francisco State University, 1600 Holloway Ave., San Francisco, CA, 94132, USA

<sup>b</sup> University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269-1041, USA

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### ABSTRACT

This paper examines the individual and team-level predictors of improvement in student teamwork effectiveness following peer-evaluation (PE) feedback. The goal of this study is two-fold: first, to understand the differences in students' initial reactions to PE feedback, as well as their subsequent decisions and actions to improve; and second, to identify the team-level processes that contribute to improvements in students' teamwork effectiveness. The mixed-methods study design combines the benefits of qualitative and quantitative data collection and analysis. The sample consists of 266 undergraduate students in 51 teams, working together for the duration of one academic semester. Data were collected in multiple waves, using open-ended surveys and interviews, as well as a standardized online PE system. Both the qualitative and quantitative analyses revealed that PE feedback is the most salient factor influencing students' improvement in their teamwork effectiveness. Moreover, students' grade aspirations and prior experience using the PE system are positively related to the level of improvement in teamwork effectiveness. The team-level factors have more complex effects, with different team processes influencing improvement along different dimensions of teamwork effectiveness. These findings have important pedagogical implications for improving students' teamwork effectiveness.

### 1. Introduction

With the increasing use of teams in organizations (Cohen & Bailey, 1997; Mathieu et al., 2019; Rapp et al., 2021) – defined as “two or more individuals who socially interact (face-to-face or, increasingly, virtually); possess one or more common goals; are brought together to perform organizationally relevant tasks; exhibit interdependencies with respect to workflow, goals, and outcomes; have different roles and responsibilities; and are together embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment” (Kozlowski & Ilgen 2006, p. 79) – corporate recruiters have been placing greater emphasis on hiring business school graduates with strong teamwork skills (Alsop, 2002). According to the Job Outlook 2020 survey of the National Association of Colleges and Employers, the highest ranked attribute that employers seek on a candidate's resume

\* Corresponding author.

E-mail addresses: [apetkova@sfsu.edu](mailto:apetkova@sfsu.edu) (A.P. Petkova), [monique.domingo@uconn.edu](mailto:monique.domingo@uconn.edu) (M.A. Domingo), [ericlamm@sfsu.edu](mailto:ericlamm@sfsu.edu) (E. Lamm).

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is the ability to work as part of a team, with over 86 percent of the respondents seeking evidence that college graduates have mastered teamwork skills, as compared to 78 percent in 2015 (Job Outlook 2020).<sup>1</sup> At the same time, business students today often come to college with “less-developed social skills for working face-to-face with others, because they have grown up using technologies like Facebook, texting, and email” (Loughry et al., 2014, p. 6). This apparent disconnect between students’ aptitudes and corporate recruiters’ expectations, in turn, poses increasing demands on business schools, and especially on management educators to do a better job of coaching students to develop relevant skills (Page et al., 2020).

Business educators have responded by increasingly incorporating team projects and other team assignments into learning activities, to better prepare students for the demands of the present-day workplace (Loignon et al., 2017; O’Neill et al., 2017). However, providing students with opportunities to work with others on team projects does not automatically produce the desired educational outcomes – i.e., students who can work effectively in teams (Oakley et al., 2004). In fact, many students would argue that they don’t feel like they get the chance to work with others but are *required* to work with others due to issues such as social loafing (Jassawalla et al., 2009), domineering peers, and inattentive teammates (Bacon et al., 1999). Although there is undoubtedly value in learning-by-doing (Kolb, 2014), it is up to the instructor to design effective learning experiences by guiding and coaching students (Bacon et al., 1999) and by helping them learn how to interact with others in the most productive ways (Chapman & Van Auken, 2001; Chen et al., 2004). Without assistance, student teams may underperform and students may walk away from their business school experience with a negative attitude toward working in teams. Such an attitude could severely harm their employability and potential for career success. Research shows that instructors play a key role in designing and implementing peer-evaluation (PE) and feedback delivery systems (Brutus et al., 2013; Loignon et al., 2017; Peterson & Peterson, 2011), which increases team member effort and performance due to the accountability measures put in place and the feedback provided (Brutus & Donia, 2010; Davison et al., 2014).

Overall, there is agreement on the importance of providing high-quality feedback in teams. However, the majority of feedback research focuses on the relationship between feedback and various performance outcomes (see Gabelica et al., 2012, for a comprehensive review). Far less research attention has been devoted to the potential contingent effects of PE feedback on improvement in students’ teamwork effectiveness – defined as the extent to which team members “effectively exchange information and resources with, actively collaborate with, and respond to other team members’ needs and requests in an appropriate manner” (Farh et al., 2012, p. 891) – as a function of individual and team-level factors. At the individual level, the same feedback content (e.g., ‘you are a below-average team contributor’) may be interpreted and acted upon differently depending on the focal student’s ambitions and aspirations. Further, individual efforts to contribute to the team may be more or less productive depending on the team processes in place (Eddy et al., 2013; Mathieu et al., 2019). Therefore, the goal of this study is to provide management educators with an understanding of how individual- and team-level factors influence the development and improvement of students’ teamwork-related skills following feedback. Thus, the following research questions are examined: (a) *Which students improve more (or less) upon receiving PE feedback?* and (b) *What factors influence the improvements in students’ teamwork effectiveness following feedback?*

These research questions are addressed in a mixed-methods study combining the benefits of qualitative and quantitative data collection and analysis. The sample consisted of 266 undergraduate students in 51 teams, working together for the duration of one academic semester. Data were collected in multiple waves, using open-ended surveys and interviews, as well as a standardized online PE system. The insights gained from the qualitative analysis were used to develop a set of testable hypotheses about the effects of PE scores, individual characteristics, and team processes on students’ improvement in teamwork effectiveness.

What makes this research design unique is that it addresses the scarcity of research on individual-level learning within team contexts (Dierdorff & Ellington, 2012). Using a longitudinal approach, similar to Peterson and Behfar (2003), this study examines the effects of feedback on ongoing teams conducting meaningful work. Thus, it addresses concerns in the literature that research on inter-team processes has relied heavily on laboratory settings rather than on groups that are performing meaningful tasks (Schippers, 2014). Finally, this study addresses calls for more research that explores intervention techniques to assist group reflection (Bolinger & Stanton, 2014; Schippers et al., 2014).

## 2. Literature review

Research on effective feedback suggests that the timing, frequency, specificity, and constructiveness of the feedback, contributes to its effectiveness (Hey et al., 2000). In their review, Gabelica et al. (2012) conclude that team-level feedback that is frequent, positive, shared, and available to all team members helps teams to improve performance. Additionally, they suggest that team members that have interdependent roles, set team goals, are incentivized, reflect on strategies to achieve these goals, trust each other, and believe they perform well are better able to achieve positive change. Research on individual-level feedback effectiveness highlights that the timing and the publicness of the feedback (Gabelica et al., 2012) and its exchange among the team also increases individual learning and team consensus (Harmon & Rohrbaugh, 1990). Several studies have found a positive relationship between feedback on individual-level performance and group performance (Hunter, 2006; Moreland & Myaskovsky, 2000), as well as team processes and interactions (Andonov, 2009; Kerr et al., 2005; Smith-Jentsch et al., 1996). Conversely, process feedback, or information on the way a task was performed, only improve team processes and cognitive emergent states (Gabelica et al., 2012). Studies providing both team-level and individual-level feedback echo the above characteristics of effective feedback adding that feedback is more effective when it is accurate, non-threatening, given directly to the teams it targets, and distributed equally (Gabelica et al., 2012).

<sup>1</sup> Retrieved March 3, 2021 from <https://www.nacweb.org/talent-acquisition/candidate-selection/key-attributes-employers-want-to-see-on-students-resumes/>.

Further, the performance feedback literature shows that individuals vary greatly in their openness to feedback. Feedback orientation indicates the degree to which individuals are willing to be evaluated, believe that feedback can be helpful, and feel accountability for the feedback received (London & Smither, 2002). Feedback orientation is correlated with feedback acceptance and proclivity for continuous learning (Smither et al., 2005). Linderbaum and Levy (2010) expand on this literature and find that accountability and self-awareness influence positively one's intentions to act upon the feedback. At the team level, research on team performance has focused on the positive impact of team reflexivity, a deliberate reflective feedback process to improve team information-processing by discussing goals, processes, and outcomes (Schippers et al., 2014). Similarly, work on debriefing has demonstrated how teams that debrief outperform those that do not (Allen et al., 2018; Eddy et al., 2013; Tannenbaum & Cerasoli, 2013).

The few pedagogical studies examining the role of feedback for learning and performance of student teams have focused on four relevant factors that may affect the impact of feedback on subsequent improvements in students' teamwork effectiveness. The first is students' prior experience using a PE system. For example, Brutus and Donia (2010) observe that students who participated in the PE system in the previous semester were more effective team members and performed better than those who used the system for the first time. They explain these differences with the experience gained through exposure to the PE system, which familiarized students with the evaluation criteria and their team members' expectations.

A second factor is students' increase in self-awareness. For example, Baker (2008) argues that providing feedback to students may increase their self-awareness "by learning how they were perceived by their teammates" (Baker, 2008, p. 186). Mayo et al. (2012) had MBA students rate themselves on their leadership qualities and had members of their teams rate them as well. In two subsequent rounds of data collections, they found that the individuals' self-ratings decreased to align with how their peers had rated them and the effect was stronger for women than it was for men. From a lens of self-confidence this may be perceived as a negative result, but from a lens of improvement, an increase in a sense of self-awareness is very important. In a study expanding on feedback orientation, social awareness was found to positively influence intentions to respond to the feedback (Linderbaum & Levy, 2010).

A third factor has less to do with the student receiving the feedback and more with their peers. LePine and Van Dyne's (2001) attributional model suggests that seeing a low performer triggers the attribution process which influences team members' behaviors. While peers are capable of engaging in helping behavior, they will likely base their response on whether they believe the low performers are able to control the outcome of their performance. Therefore, peers might respond in one of four different ways: compensating, training, motivating, or rejecting the low performer (LePine & Van Dyne, 2001). The way in which peers respond will have a direct effect on the improvement potential of the student. Jackson and LePine (2003) used student samples and found empirical support for significant aspects of the attribution model.

Finally, a fourth factor is the team dynamics at the time of the intervention. Peterson and Behfar (2003) looked specifically at how the type of feedback affected subsequent student team processes. They found that negative feedback (i.e., low project grades at Time 1) predicted relationship conflict and task conflict at Time 2. Further, intergroup trust was successful at stopping task conflict from transforming into relationship conflict. Others find that prior team interactions change individual expectations for the next group interaction, for member satisfaction with the group, and for member willingness to continue contributing to the group (Andonov, 2009; Behfar et al., 2008; Jehn, 1997; Lind & Tyler, 1988).

Although prior research on feedback in teams offers valuable insights about the effects of different types of feedback on individual- and team-level outcomes, more work is needed to understand the differences among team members in their reaction to feedback and subsequent improvement. As class projects conducted in teams are becoming more prevalent, especially within business schools, it is important to understand how exactly high-quality feedback plays a role for different students and within different student-teams. This study seeks to fill this gap by providing a deeper understanding of the factors that influence whether and to what extent team members would improve upon receiving high-quality PE feedback. Further, given that the role of feedback in student teams has been rarely studied outside of controlled laboratory experiments, the study aims to add value by providing a more realistic picture of students' response to PE feedback when working on meaningful tasks, in real teams, for an extended time-period.

### 3. Study design and methods

#### 3.1. Research setting

The mixed-methods study design combines the benefits of qualitative and quantitative data collection and analysis. The sample for this study consists of 266 undergraduate management students at a large public university, with a highly diverse student population. Students were enrolled in nine sections of a dedicated elective course titled Seminar in Managing Teams. The nine sections were spread across three semesters. As the course was elective, it can be assumed that all study participants had at least some interest in learning how to work effectively in teams. All students had previously taken lower-level management courses. Students worked together in 51 teams for the duration of one academic semester.

The course was based on experiential learning and skill development. Students had weekly reading assignments that covered theories and concepts, with class time dedicated to translating the concepts into specific skills and processes. Skills were evaluated while conducting competitive exercises in the classroom where teams engaged in challenging and engaging competitions. Designated observers took notes on their performance and the full class engaged in a 30 to 60-min discussion/reflection at the end of each class session.

Teams also had several deliverables designed to reinforce the team-members' interdependence and accountability, including: four small team projects (20 percent of the course grade); weekly quizzes on the material assigned for each class, for which one team-

member was chosen at random to take the quiz on behalf of the entire team (15 percent of the course grade); and a final field-based research project (20 percent of the course grade). The final project was quite demanding. It involved finding two external work teams in any industry, conducting interviews with five members of each team asking a minimum of 50 questions (from a list of 200 sample questions), transcribing and content-analyzing the interviews to develop deep understanding of the workflow, team interactions, and problems faced by these teams. This field research culminated in presenting a comparative analysis of the work teams with recommendations for improvement in an oral presentation to the class. The purpose of this demanding team project was to ensure that the teammates interact continuously outside of the classroom (about three to 5 h a week), in order to complete the task, and that the students realize that their teams' performance depends on everyone contributing to the best of their abilities. Collectively, all team assignments accounted for 55 percent of the final course grade, thus making each team-member's grade directly tied to the team's performance. The remaining 45 percent of the course grade were based on individual performance on class participation, a midterm, and a final exam.

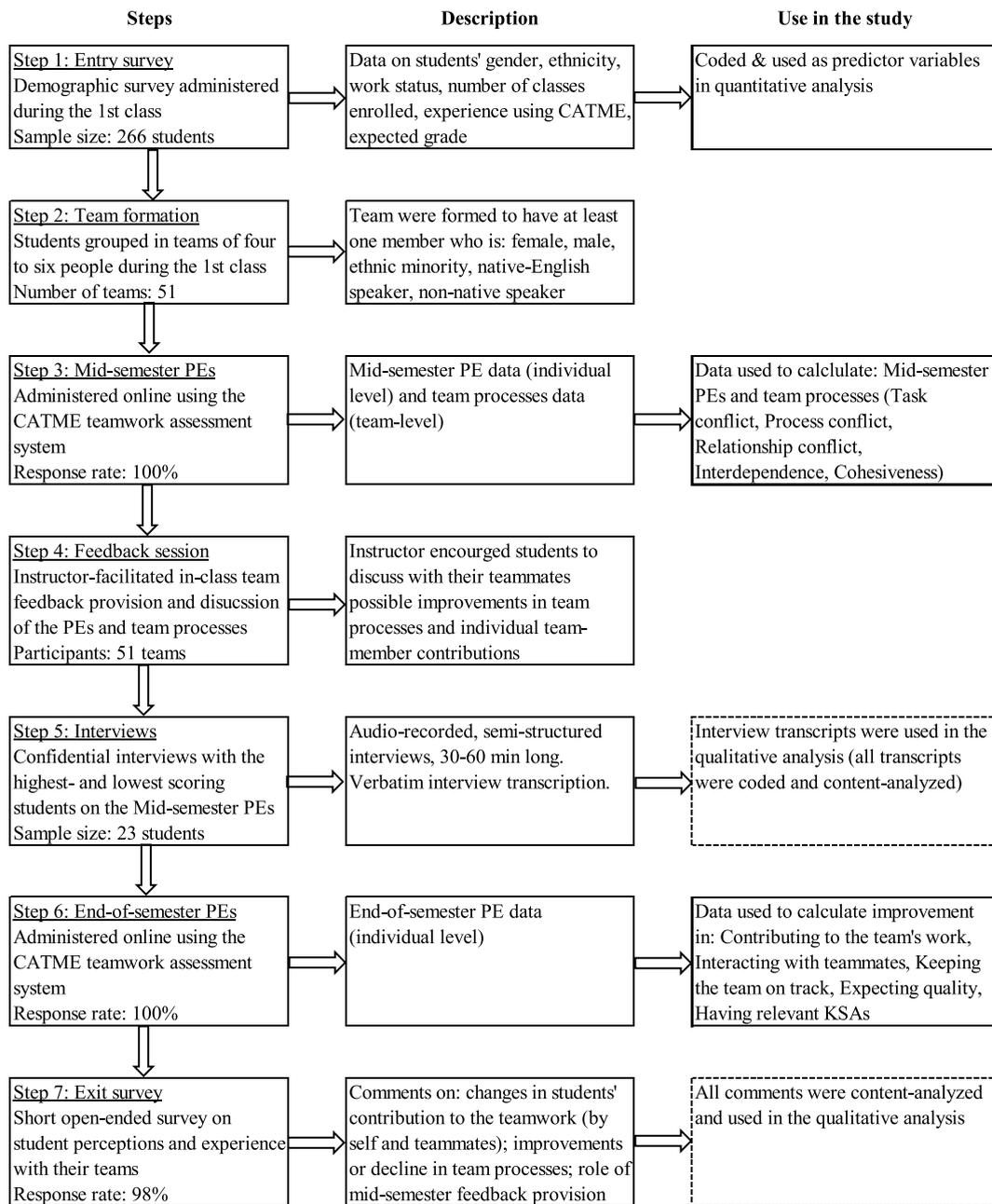


Fig. 1. A Flow Chart of the Research Methodology

Note: Dotted lines indicate data used in qualitative analyses; thick solid lines show data used in quantitative analyses.

### 3.2. Research methodology

Fig. 1 provides a step-by-step flowchart of the research process along with a brief summary of the type of data collected at each step and how these data were used in subsequent analyses.

#### 3.2.1. Step 1: Entry survey

A demographic survey was administered on the first day of the semester. The survey was used to obtain data on students' gender, ethnicity, work status, number of classes enrolled, experience using the PE system, and expected grade in this class. The students that participated in this study identified themselves among 45 different nationalities and ethnicities with 32 students noting that they were of mixed ethnicities. Further, 46% of the students (122 students) were female, 90% of the students (240 students) were enrolled in at least three classes, and 80% of the students (212 students) worked at least part-time in addition to attending school. To avoid potential bias, these data were kept confidential (i.e., the instructor had no access to the data).

#### 3.2.2. Step 2: Team formation

Also, on the first day of the semester all students were guided to self-select into permanent teams for the duration of the semester. Each team was required to have at least one team member who was: female, male, ethnic minority, native English speaker, non-native speaker. The team-formation was monitored by the instructor to ensure that all teams were similarly diverse. Teams were asked to develop detailed team contracts in which they addressed over 30 questions about their processes for determining procedures, expectations, and consequences. Students were advised of the purpose of the team projects, the expectation to contribute equally to the team, and that PEs would be used to evaluate each student's contribution to the team.

#### 3.2.3. Step 3: Mid-semester PEs

At mid-semester, students were asked to privately and confidentially evaluate themselves, their teammates, and their team's processes using a standardized online PE system. Students were told that the mid-semester PE would not affect their grades but was a useful barometer of how the team was progressing. All students completed the online PEs (100 percent response rate).

The PE data were gathered using the Comprehensive Assessment for Team Member Effectiveness (CATME) system. CATME was developed and validated by a cross-disciplinary multi-university team of researchers (Loughry et al., 2007; Ohland et al., 2012). CATME is publicly available for educational use (see [www.catme.org](http://www.catme.org)). This study uses CATME's behaviorally anchored rating scales (BARS) which were developed using Hedge et al.'s (1999) critical thinking methodology and validated through a series of studies described in detail by Ohland et al. (2012). CATME BARS measure five dimensions of teamwork effectiveness – *Contributing to the team's work*, *Interacting with teammates*, *Keeping the team on track*, *Expecting quality*, and *Having relevant knowledge, skills, and abilities (KSAs)*. In addition, CATME provides the option to collect team-level data on several team processes, including task conflict, process conflict, relationship conflict, cohesion, and interdependence.

#### 3.2.4. Step 4: Feedback session

The default CATME option – used by most instructors – is to release the feedback to students electronically. The CATME-generated feedback comes in a qualitative form (e.g. "The members of your team indicated that your contributions to the team were below expectations"). The downside of such electronic feedback provision is that it might have marginal impact for some students as they may not know how to interpret it or may prefer to avoid the issue rather than bringing it up for discussion with their team. To address these limitations of the online PE system, the intervention described in this study was designed as a face-to-face feedback session where the instructor met with each team and presented the data, in order to encourage teams to have a frank conversation and to ensure the feedback was used for improvement.

The instructor provided feedback in quantitative form demonstrating how the CATME scores would affect the students' course grades should the same results appear on the end-of-semester CATME. For some teams, this proved to be an extremely awkward and emotional revelation as teammates had received unexpectedly low individual scores. This feedback delivery method was specifically designed to ensure all students understood the importance of their CATME scores and knew how to address feedback on their teamwork effectiveness. The face-to-face interaction allowed the instructor to help students interpret the standardized feedback by answering questions and guiding them in developing strategies to improve their teamwork effectiveness. The instructor used the opportunity to also draw students' attention to the team-level data and to point out any anomalies in their team processes, such as low levels of task conflict or high levels of relationship conflict. This approach was designed based on research on the benefits of guided debriefing (Allen et al., 2018; Eddy et al., 2013; Tannenbaum & Cerasoli, 2013), team reflexivity (Schippers et al., 2014), training teams on the effective use of conflict (O'Neill et al., 2017), and the importance of peer feedback seeking on a team's health and effectiveness (De Stobbeleir et al., 2020).

#### 3.2.5. Step 5: Interviews

After completing the mid-semester CATME survey, the aggregated PE scores were reviewed to identify students who fell in one or more of the following categories: students scoring very high or very low on a team of mixed-performers, members of a team of high-performers, and students who were under-confident or over-confident relative to their teammates' assessment. The students with the lowest and the highest scores (a total of 23 students) were selected for in-depth interviews because such 'outliers' were most likely to exemplify the phenomenon of interest for this study (Yin, 1994). Interviewing these students was designed to provide insights into their immediate reactions to the PE feedback, the reasons for these reactions, students' intentions for change, and the rationale behind

them.

A few days in advance of the class session in which the feedback was going to be administered, the 23 students were contacted by a research assistant to volunteer to be interviewed. The research assistant was unfamiliar with the students' scores and the reasons why they were selected for interviews. One-on-one private confidential interviews were requested for the days immediately following the class feedback session. Securing enough volunteers was of concern because the interviews were scheduled to take about 1 h and required students to come to the interview location outside of class time. To encourage participation by both high and low performers, and to compensate them for their time, all selected students were offered extra credit equal to one and a half percentage points of their course grade. This is a standard practice and consistent with prior research published in leading management education journals (Carriger, 2016; Halbesleben & Wheeler, 2009; Rosenblatt et al., 2013; Williams, 2009). In addition, to ensure honest and accurate responses, students were guaranteed full confidentiality. To avoid any potential bias, the instructor had no access to the interviews. All students agreed to the interview invitations unaware that an intervention was about to take place. The same research assistant conducted the semi-structured interviews, which lasted from 30 to 60 min and covered 22 questions about the individual and team goals, team environment, communication, and feedback intervention. Students were also encouraged to share any additional opinions they felt were related to the above topics. All interviews were audio-recorded and transcribed verbatim. The interview transcripts were content analyzed and coded by two independent coders who extracted the major themes within each group of questions.

3.2.6. Step 6: End-of-semester PEs

At the end of the semester, the standardized online PEs using CATME were administered again. This time the students' scores were factored into their final grades. All students completed the PEs (100 percent response rate). The data were used to calculate student improvements in the five dimensions of teamwork effectiveness – Contributing to the team's work, Interacting with teammates, Keeping the team on track, Expecting quality, and Having relevant knowledge, skills, and abilities (KSAs).

3.2.7. Step 7: Exit survey

At the end of the semester, a short survey was administered, asking open-ended questions about student perceptions of the impact that the mid-semester feedback had on their own and their teammates' subsequent contributions, as well as its effect on the team as a whole. This survey was distributed to all students; 260 returned completed useable surveys (98 percent response rate). The survey responses were content-analyzed and coded similarly to the interviews. The data was kept confidential as the instructor had no access to the data.

Together, these steps provided robust data that enabled the performance of in-depth and systematic qualitative and quantitative analysis. Following is a more detailed description of the variables that were used in the quantitative analysis.

3.3. Variables for quantitative analysis

The data collected in Step 1 (entry survey), Step 3 (mid-semester PEs), and Step 6 (end-of-semester PEs) were used to calculate variables for the quantitative analysis. All variables are explained in detail below and summarized in Fig. 2.

3.3.1. Dependent variables

The raw student ratings from the mid-semester and end-of-semester CATME surveys were used to calculate students' PEs on a given dimension as the average of the scores received from their teammates (excluding the student's self-ratings). The response scales have behavioral anchors for high (5), medium (3) and low (1) team-member performance in each category, providing an option for students

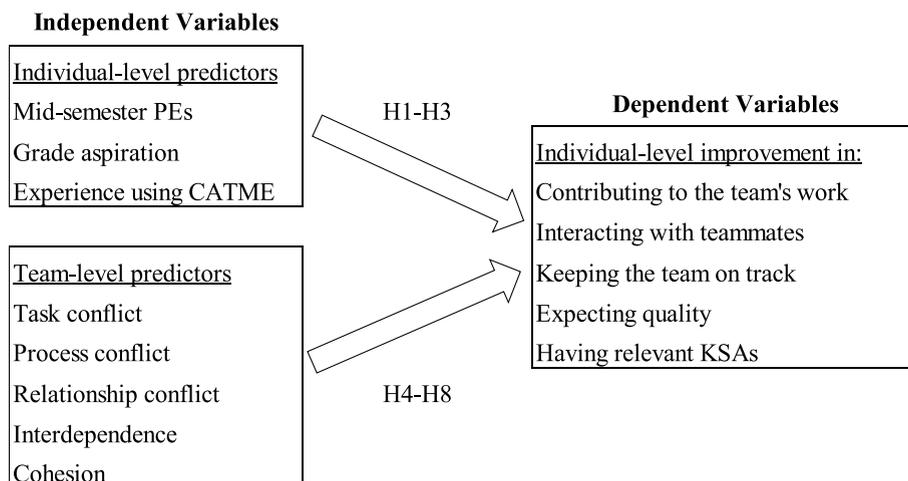


Fig. 2. Summary of the variables used in the quantitative analysis.

to assign a rating between these levels, respectively equivalent to 4 or 2. Thus, each rating, and respectively each average, is allocated a value from 1 to 5, where 1 is the lowest and 5 is the highest anchor. Students' improvement on each dimension of teamwork effectiveness was calculated by subtracting the mid-semester from end-of-semester scores. All scores were standardized prior to calculating the differences. This *improvement* variable can take both positive and negative values, as well as zero (no change), depending on the focal student's improvement in teamwork evaluations on a given dimension.

### 3.3.2. Independent variables

*Mid-semester PEs* were calculated as the averages of each student's PEs on each of the five dimensions of CATME. The standardized scores were used in the analysis, to take into account students' relative performance in comparison to their classmates. *Grade aspirations* were measured as the numerical value corresponding to the students' aspired grade for this class as stated in the entry survey at the beginning of the semester (e.g., 4 for A, 1.7 for C-). *Familiarity with CATME* was measured as a binary variable taking the value of 1 if students had used CATME before and 0 if they had not, as indicated in the entry survey.

The team-level processes were measured using the scores generated by CATME for each team, based on the aggregate mid-semester team-members' ratings of Task conflict, Process conflict, Relationship conflict, Interdependence, and Cohesion. Individual student responses on each scale are automatically aggregated and averaged by the CATME system's algorithm, so they take values from 1 (lowest) to 5 (highest) of each process. All scores were standardized prior to including them in the analysis.

## 4. Analysis and results

This section presents the insights derived from the qualitative analysis of the semi-structured interviews, followed by the quantitative analysis and results, and concluding with the observations from the qualitative analysis of the exit surveys. The results and conclusions from the qualitative analysis of the interviews were used to develop formal hypotheses. These hypotheses were tested using the quantitative data described earlier.

### 4.1. Insights from the interview analysis

The first goal of this study was to understand the differences in students' initial reactions to feedback, as well as their subsequent decisions and actions. Specifically, the interview data provide insights into the following questions: How did students react to the feedback immediately upon receiving it and why? What factors influence the extent to which the students would use the feedback as an impetus to improve?

The semi-structured interviews show that the aggregated PE feedback provided by the instructor was perceived as helpful and beneficial by most students. Of the 23 students interviewed, 83 percent perceived the intervention as helpful, 65 percent stated that it raised awareness and served as a beneficial self-assessment of where they stood on the team, and 63 percent specified that it provided an opportunity for students to improve. Further, 35 percent of the students were glad that they received their scores in front of the entire team, and 26 percent explicitly stated that the face-to-face feedback provision increased accountability. Overall, it is fair to conclude that the feedback provision accomplished its purpose, as it was taken seriously by most of the students interviewed, whether enthusiastically or reluctantly.

However, there was a wide range of reactions to the specific feedback received, in terms of attributions, interpretations, intended actions, and rationales. Sixty percent of the students interviewed (14 students) intended to make a positive change in their own contributions to the team. The other nine students planned to either keep the same level of effort or reduce their contributions and let others do more.

#### 4.1.1. PE scores

The lower-scoring students varied in their emotional reactions to the PE feedback they received but all stated an intention to improve. Some students admitted that their relatively low scores were not necessarily unfair, as they did not contribute to the best of their ability. As one student said: "At first you get hit with that original, kind of like, 'screw these guys' feeling. But once you think about it, it reflects what you've given the group." After receiving the feedback, this student intended to step up his contribution for the rest of the semester: "My biggest thing is procrastination. I have to make sure I get things done and give myself some time to memorize the material" (referring to the preparation needed to do well when taking the weekly quiz on behalf of the entire team). Another student said: "I say it affected me positively where I want to learn from it and go from there to perform better ... I want to contribute more for the upcoming projects and presentations."

Other students were upset with their low scores and felt that their teammates were not giving them enough credit for their work. For example, one student said: "It really made me mad. It's almost like them saying that they have more knowledge, skills, and ability than me". Another student complained: "It sucked. It didn't feel good. Just because mine was the lowest [score] and it felt like they plotted it against me". Despite their initial negative emotions, these students still intended to make changes in certain behaviors identified during team meetings. For example, one student intended to provide more input by voicing his opinions more often: "If I was able to talk about everything that I wanted to, then I'd feel really good about it, which will for sure improve my performance." Another student said: "I don't think they were aware of what I did. It did make me think about it." Overall, the fact that all under-performing students stated their intention to improve suggests that instructor intervention and guidance after delivering the PE feedback channeled their disappointment into the right direction, preventing them from discarding the negative feedback or disengaging from their teams.

In contrast to the lower-scoring students, the students who received the highest scores on their teams reported uniformly positive emotional reactions. When asked how they felt when the instructor delivered the feedback in front of their teams, they responded: "I felt juiced about mine because I know the work I do and the contribution I make" and "I felt really happy internally, thinking that I'm doing my part and that I'm solid." One of the highest scoring students answered: "It was really nice to see it on paper and say, 'Oh wow, I would have gotten a 1.22!'" (referring to the CATME adjustment factor that would be used to raise the student's grade 22% above the team average). However, the high-scoring students varied in their intentions for the rest of the semester. Although a few of those students intended to work even harder, others were already happy with where they were, and yet others stated that they planned to reduce efforts, because they realized that they were carrying teammates or by doing too much they were leaving less room for timid teammates to contribute. For example, one student expressed an intention to delegate more: "I think I'll just take some [tasks] away from me. I'm a little bit of a perfectionist so it's kind of hard for me, but I'm going to do it anyway." Another high-scoring student said: "It just tells me that I should continue being myself and keep doing what I'm doing." Overall, the students who got the highest scores on each team did not see much room for improvement because in comparison to their teammates they were already contributing much more.

Based on these observations, the PE scores undoubtedly played a major role in both students' initial reaction to the feedback and their decisions to initiate subsequent behavioral changes. The lower-scoring students varied in their emotional reactions but all stated an intention to improve. This is consistent with prior studies showing that feedback recipients who initially received low ratings subsequently improved more than others (Smither et al., 1995; Walker & Smither, 1999). In contrast, the emotional reactions of the students who received the highest scores on their teams were all positive. However, some of them interpreted their high scores as indicating that they had been doing the work of others and thus planned to reduce their efforts for the rest of the semester. Therefore, it is expected that the lower-scoring students would improve their teamwork effectiveness more following PE feedback.

Prior research suggests that feedback recipients are more likely to perceive a need for change in their behavior when there is a discrepancy between self-perceptions and feedback from others (London & Smither, 1995). In the context of this study, the highest discrepancy is likely to be experienced by the lowest-performers, who – as evident from the interviews – prior to the feedback sessions were unaware of the extent to which they were underperforming relative to teammates. Finally, the lowest performers have objectively the most room for improvement, especially when compared to the highest contributors who already are receiving close to maximum scores. Together, these arguments lead to the following hypothesis:

**H1.** Students' mid-semester PE scores will be negatively related to their improvement in teamwork effectiveness by the end of the semester.

#### 4.1.2. Individual level factors

In addition to the PE scores, which were very salient on students' minds at the time of the interviews, some students mentioned their grade aspirations and/or experience with CATME from previous classes. Students with various scores referred to their aspired grades as a reason for putting more effort into their team's work. For example, one student said: "[the feedback] is motivating because it's like being in last place and I want to be in first place." Another student explained: "If I didn't get the CATME, I may have even stayed on the original road I was on and at the end of the day I wouldn't have gotten the full credit of our grade."

Since the team project and the other team assignments constituted a substantive portion of the course grade (55 percent), it is logical to expect that students with higher aspirations would be motivated to put more effort into improving their teamwork effectiveness in order to receive higher ratings from their peers. For example, some of the lower-scoring students interviewed aspired for an A in the class and thus were determined to do everything needed to improve their teamwork effectiveness. Based on these observations, the second hypothesis is:

**H2.** Students' grade aspirations will be positively related to their improvement in teamwork effectiveness by the end of the semester.

A few students mentioned experience with CATME from previous classes as a point of comparison. Although they did not explicitly discuss this experience as a source of better understanding of the PE system and criteria, prior research suggests that such students may be better able to improve their teamwork effectiveness by engaging in the desired behaviors. In a study of a similar standardized PE system, Brutus and Donia (2010) found that students exposed to the system in one semester were rated higher by their teammates in the subsequent semester, and concluded that the experience with using the system itself helped students improve their teamwork skills. Recent studies of rater experience with standardized PE systems also provide evidence that student understanding of teamwork effectiveness improves with repeated exposure to the system (Brutus et al., 2013; Loignon et al., 2017). Therefore, it is hypothesized that:

**H3.** Students' familiarity with the PE system will be positively related to their improvement in teamwork effectiveness by the end of the semester.

#### 4.1.3. Team processes

Several students referred to either positive or negative aspects of their team interactions to explain their reactions to the mid-semester scores and/or their intention for improvement. On the positive side, most salient were considerations related to team

interdependence and cohesion, especially accountability and trust among team members.<sup>2,3</sup> Students on more cohesive teams seemed to have an easier time understanding what was needed to improve and felt motivated to contribute to the best of their ability. As one student said: “I think we are all in it together now.” Another student explained: “I definitely do feel like I have trust from my teammates and it really motivates me to work harder for the project.” Robust team processes also made the discussion of gaps in students’ teamwork skills easier, which left those students with a clear understanding of what they needed to do to address teammates’ concerns. For example, after discussing with their teammates, some students realized the importance of timeliness when working on a team with tight deadlines: “Members are opening their availability. Members are trying to meet deadlines. I requested a day off [from work] for the final project. Members are volunteering instantly” – explained one student. Another under-performing student justified confidence that his team will meet its goals with his own intention to contribute more: “Seeing that I wasn’t contributing to the fullest of my ability and now knowing I will put in more, they are getting more effort from another person, which is only going to help.” Another student expressed satisfaction with the fact that the ‘difficult’ conversation “... definitely improved cohesion and established better relationships in the team, which will lead us to perform better in the future. Since we have good trust, it will definitely bring better conflict. We didn’t have a lot of task conflict.”

Productive resolutions of process conflict, especially those regarding expectations about communications, were also shared in a positive tone.<sup>4</sup> As one student explained, “We agreed that communication is key. If you don’t communicate, then others won’t really know how much you actually contributed to the group. From now on, we should communicate what we have done for the group so that others don’t misinterpret that we haven’t done as much as we should and think that we have to do more.” Another student summed up: “The more we talked about it the better it got.” It did not appear that process conflict was too high in any of the teams though, which could be explained by all teams being required to sign team contracts at the beginning of the semester that specified roles and responsibilities.

On the negative side, relationship conflict was discussed as something negative and disruptive to the team’s work.<sup>5</sup> For example, one student explained his disappointing score as follows: “They rated my score based on the fact that they hate me not my performance, because I pretty much did the most work out of everyone.” He clearly stated his intention to keep the same level of effort (not to improve) but to keep record of everything he does for the rest of the semester, so that he could report to the instructor if his teammates’ ratings at the end of the semester were again unfair. Another student, despite having received a high mid-semester score, was really concerned with the relationship conflict on her team, and discussed her intention to try to remedy the situation: “I think maybe we all need to sit down and talk about the priorities that we have and how everyone is contributing. I might do a one-on-one thing.” Overall, whenever students referred to relationship conflict it was viewed as an obstacle to their own and/or their teammates’ improvement in teamwork effectiveness.

These observations suggest that the (positive) team processes may increase students’ motivation to improve their teamwork effectiveness. Since all processes, except for relationship conflict, were used in a positive connotation by the students, it is expected that they would contribute favorably to student improvement in teamwork effectiveness. In contrast, relationship conflict was discussed only in a negative connotation, which is consistent with prior research showing that relationship conflict has detrimental effects on team outcomes (de Wit et al., 2012; Jehn & Mannix, 2001; Mathieu et al., 2019). Although task conflict was only mentioned briefly in the interviews, it is included in the hypotheses, because prior research typically studies the three types of conflict (task, process, and relationship) in comparison (de Wit et al., 2012; Mathieu et al., 2019).<sup>6</sup> Therefore, the following hypotheses were formulated:

- H4.** Teams’ task conflict will be positively related to students’ improvement in teamwork effectiveness by the end of the semester.
- H5.** Teams’ process conflict will be positively related to students’ improvement in teamwork effectiveness by the end of the semester.
- H6.** Teams’ relationship conflict will be negatively related to students’ improvement in teamwork effectiveness by the end of the semester.
- H7.** Teams’ interdependence will be positively related to students’ improvement in teamwork effectiveness by the end of the semester.
- H8.** Teams’ cohesion will be positively related to students’ improvement in teamwork effectiveness by the end of the semester.

#### 4.2. Quantitative analysis and results

Table 1 shows the correlations and descriptive statistics for all variables in the study. The highest correlations are of students’ mid-semester scores on Contributing to the team with Interacting with teammates and Keeping the team on track (0.80 and 0.81,  $p < .001$ ). The correlations among the improvements on the five dimensions of teamwork effectiveness are between 0.60 and 0.77 ( $p < .001$ ), with the highest correlation between improvements in Contributing to the team’s work and Keeping the team on track. These

<sup>2</sup> Team cohesion reflects “emotional attraction among group members and the ties that bind the group together” (Thompson, 2018, p. 94).

<sup>3</sup> Interdependence means that “team members cannot achieve their goals single-handedly, but instead, must rely on each other to meet shared objectives” (Thompson, 2018, p. 94).

<sup>4</sup> Process conflict is defined as “disagreements among group members about the logistics of tasks” (de Wit et al., 2012, p. 362).

<sup>5</sup> Relationship conflict is defined as “disagreements among group members about interpersonal issues, such as personality differences or differences in norms and values” (de Wit et al., 2012, p. 362).

<sup>6</sup> Task conflict is defined as “disagreements about the content and outcomes of the task itself” (Mathieu et al., 2019, p. 29).

**Table 1**  
Correlations.

Variable name	1	2	3	4	5	6	7	8
1. Improvement in CT								
2. Improvement in IT	.74							
3. Improvement in KTT	.77	.74						
4. Improvement in EQ	.70	.68	.70					
5. Improvement in KSAs	.64	.60	.66	.65				
6. Mid-semester score on CT	-.50	-.32	-.34	-.36	-.26			
7. Mid-semester score on IT	-.46	-.56	-.43	-.44	-.33	.80		
8. Mid-semester score on KTT	-.40	-.34	-.55	-.38	-.32	.81	.77	
9. Mid-semester score on EQ	-.32	-.24	-.25	-.54	-.27	.76	.73	.71
10. Mid-semester score on KSAs	-.34	-.28	-.34	-.41	-.51	.77	.71	.77
11. Grade aspirations	-.01	-.04	-.02	-.07	.05	.20	.14	.21
12. Familiarity with CATME	-.01	-.02	-.02	-.06	-.00	.20	.21	.20
13. Task conflict	-.01	.05	.17	.10	.11	.03	-.02	-.08
14. Process conflict	.15	.10	.21	.24	.14	-.28	-.29	-.31
15. Relationship conflict	.16	.15	.18	.26	.19	-.31	-.33	-.27
16. Interdependence	-.00	.03	.05	-.02	-.01	.18	.21	.12
17. Cohesion	-.17	-.12	-.15	-.25	-.13	.44	.44	.37
Variable name	9	10	11	12	13	14	15	16
10. Mid-semester score on KSAs	.77							
11. Grade aspirations	.20	.16						
12. Familiarity with CATME	.26	.27	-.03					
13. Task conflict	-.01	.00	-.01	-.01				
14. Process conflict	-.31	-.25	-.03	-.04	.57			
15. Relationship conflict	-.36	-.35	-.12	-.08	.47	.75		
16. Interdependence	.27	.19	.13	-.00	-.12	-.21	-.20	
17. Cohesion	.50	.41	.16	.09	-.36	-.64	-.72	.51

Note: N = 266. All correlations with an absolute value of 0.12 and higher are significant at  $p < .05$  level. CT=Contributing to the teamwork; IT=Interacting with teammates; KTT=Keeping the team on track; EQ = Expecting quality; KSAs=Having relevant knowledge, skills, and abilities.

correlations suggest that the common variance between any two dependent variables is between 36 and 59 percent, which is not high enough to warrant combining them into one aggregate variable. Therefore, separate sets of analyses were performed for each dimension of teamwork effectiveness.

The effects of the individual and team-level variables were tested using a series of Ordinary Least Squares (OLS) regression analyses. Table 2a–e shows the results of the OLS regressions for students' improvement in each dimension of teamwork effectiveness (labeled from "a" to "e" respectively). Model 1 in each set of analysis includes the individual-level variables, mid-semester scores, grade aspirations, and familiarity with CATME. Models 2 through 6 introduce each team-level process, and Model 7 includes all variables together.

As predicted by H1, the five mid-semester PE scores have significant negative relationships with students' improvement in the respective dimensions of teamwork effectiveness ( $b = -.54$ ,  $p < .001$  for Contributing to the team's work;  $b = -.58$ ,  $p < .001$  for Interacting with teammates;  $b = -.59$ ,  $p < .001$  for Keeping the team on track;  $b = -.57$ ,  $p < .001$  for Expecting quality; and  $b = -.58$ ,  $p < .001$  for Having KSAs). These results provide strong support for H1. Grade aspirations have positive relationships with students' improvement in Contributing to the team's work ( $b = 0.11$ ,  $p < .05$ ), Keeping the team on track ( $b = 0.11$ ,  $p < .05$ ), and Having KSAs ( $b = 0.15$ ,  $p < .01$ ), but not on Interacting with teammates and Expecting quality. Thus, H2 is partially supported. Consistent with H3, prior experience with CATME has positive relationships with students' improvement in all dimensions of TE ( $b = 0.10$ ,  $p < .10$  for Contributing to the team's work;  $b = 0.10$ ,  $p < .05$  for Interacting with teammates;  $b = 0.11$ ,  $p < .05$  for Keeping the team on track;  $b = 0.09$ ,  $p < .10$  for Expecting quality;  $b = 0.15$ ,  $p < .01$  for Having KSAs).

Hypotheses 4 to 8 are tested by examining the effects of team-level processes on students' improvement in the five dimensions of teamwork effectiveness (Models 2 through 6). Task conflict has a significant positive relationship with students' improvement in Keeping the team on track ( $b = .12$ ,  $p < .01$ ), Expecting quality ( $b = 0.09$ ,  $p < .10$ ), and Having KSAs ( $b = 0.12$ ,  $p < .05$ ), providing partial support to H4. Process conflict has a positive relationship only with students' improvement in Expecting quality ( $b = .10$ ,  $p < .10$ ), providing weak support to H5. Relationship conflict has no significant relationship with any of the dependent variables. Thus, H6 is not supported. Team interdependence has significant positive relationships with students' improvement in all dimensions of teamwork effectiveness except for Contributing to the team's work ( $b = 0.16$ ,  $p < .01$  for Interacting with teammates;  $b = 0.11$ ,  $p < .05$  for Keeping the team on track;  $b = 0.15$ ,  $p < .01$  for Expecting quality;  $b = 0.09$ ,  $p < .10$  for Having KSAs). These results support H7. Finally, team cohesion has significant positive relationships with students' improvement in Interacting with teammates ( $b = 0.15$ ,  $p < .01$ ), providing weak support to H8. Together, the individual and team-level factors explain between 28 percent and 36 percent of the variance in students' improvement in teamwork effectiveness (see R-squared in Table 2a–e, Model 7).

**Table 2a**

DV = Improvement in "Contributing to the teamwork".

Variable name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Mid-semester score on CT	-.54***	-.54***	-.54***	-.54***	-.56***	-.56***	-.56***
Grade aspirations	.11*	.11*	.11*	.11*	.10 <sup>+</sup>	.10 <sup>+</sup>	.10 <sup>+</sup>
Familiarity with CATME	.10 <sup>+</sup>						
Task conflict		.01					.00
Process conflict			.01				.02
Relationship conflict				.02			.06
Interdependence					.09		.06
Cohesion						.05	.08
R-squared	.27	.27	.27	.27	.27	.27	.28

**Table 2b**

DV = Improvement in "Interacting with teammates".

Variable name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Mid-semester score on IT	-.58***	-.58***	-.60***	-.59***	-.61***	-.64***	-.66***
Grade aspirations	.04	.04	.04	.04	.03	.03	.03
Familiarity with CATME	.10*	.10*	.10*	.10*	.11*	.10*	.11*
Task conflict		.04					.12*
Process conflict			-.07				-.11
Relationship conflict				-.03			.09
Interdependence					.16**		.11 <sup>+</sup>
Cohesion						.15**	.13
R-squared	.32	.32	.32	.32	.34	.34	.36

**Table 2c**

DV = Improvement in "Keeping the team on track".

Variable name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Mid-semester score on KTT	-.59***	-.58***	-.58***	-.58***	-.60***	-.61***	-.61***
Grade aspirations	.11*	.11*	.11*	.11*	.10 <sup>+</sup>	.11*	.10*
Familiarity with CATME	.11*	.10*	.10*	.11*	.11*	.10*	.11*
Task conflict		.12**					.15**
Process conflict			.04				-.04
Relationship conflict				.04			.06
Interdependence					.11*		.09
Cohesion						.05	.08
R-squared	.32	.34	.32	.32	.33	.32	.35

**Table 2d**

DV = Improvement in "Expecting quality".

Variable name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Mid-semester score on EQ	-.57***	-.57***	-.54***	-.55***	-.61***	-.59***	-.61***
Grade aspirations	.04	.05	.04	.05	.03	.04	.03
Familiarity with CATME	.09 <sup>+</sup>	.10 <sup>+</sup>	.09 <sup>+</sup>	.09 <sup>+</sup>	.11*	.10 <sup>+</sup>	.10*
Task conflict		.09 <sup>+</sup>					.07
Process conflict			.10 <sup>+</sup>				.10
Relationship conflict				.07			.02
Interdependence					.15**		.14*
Cohesion						.03	.09
R-squared	.30	.31	.31	.30	.32	.30	.34

#### 4.3. Insights from the end-of-semester survey analysis

The end-of-semester survey confirmed the benefit of the detailed feedback provided mid-semester. Specifically, 62 percent of the students believed that without the face-to-face meetings with the instructor they would have not discussed the CATME results, indicating that requiring them to talk about the feedback had a positive effect. In addition, 12 percent felt more accountable following

**Table 2e**

DV = Improvement in “having KSAs”.

Variable name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Mid-semester score on KSAs	-.58***	-.58***	-.57***	-.57***	-.59***	-.61***	-.64***
Grade aspirations	.15**	.15**	.15**	.15**	.14**	.14**	.14**
Familiarity with CATME	.15**	.16**	.15**	.15**	.16**	.15**	.16**
Task conflict		.12*					.17**
Process conflict			.01				-.07
Relationship conflict				.02			.09
Interdependence					.09 <sup>+</sup>		.04
Cohesion						.08	.16 <sup>+</sup>
R-squared	.30	.31	.30	.30	.31	.31	.34

Note: N = 266 for all models. \*\*\*p < .001, \*\*p < .01, \*p < .05, <sup>+</sup> p < .10.

CT=Contributing to the teamwork; IT=Interacting with teammates; KTT=Keeping the team on track; EQ = Expecting quality; KSAs=Having relevant knowledge, skills, and abilities.

the feedback, and 17 percent stated that the feedback raised awareness and served as a beneficial self-assessment of where they stood on the team. In terms of improvement, 83 percent of the students believed that their teammates' contributions improved following the feedback, and 18 percent specified that the teammates with the lowest scores increased their contributions. Most notably, all teams (100 percent) had at least one member who reported an improvement, with 73 percent of the respondents listing specific improvements in team-level processes following the feedback. Overall, the survey provides evidence consistent with the insights from the post-feedback interviews and the results from the quantitative analysis. One important observation is that the students with the lowest scores – who all stated intentions to improve – indeed made the efforts that were needed and appreciated by their teammates.

## 5. Discussion

The qualitative and quantitative results of this study provide important insights into the effects of PE feedback, together with individual aspirations and experience, and team processes, on teamwork effectiveness. In the quantitative analysis, the PEs emerged as the strongest predictor of student improvement in all five dimensions of teamwork effectiveness. Moreover, the interview analysis shows that the feedback sessions were essential for students to understand the reasons for receiving certain PE scores and to be able to devise strategies for improvement. Of the team processes included in this study, task conflict has positive effects on improvement in Keeping the team on track, Expecting quality, and Having relevant KSAs. In contrast, process conflict only has a weak effect on Expecting quality, whereas Relationship conflict has no significant effects on any of the five dimensions. Team interdependence is related to improvements in Interacting with teammates, Keeping the team on track, and Expecting quality, while cohesion is related to improvements in Interacting with teammates. These results have some important pedagogical implications that are discussed below.

### 5.1. Feedback sessions as a pedagogical tool

As hypothesized, the lowest performers at mid-semester improved the most by the end of the semester. Undoubtedly, this is partially due to the fact that the lower scoring students have the most room for improvement (Smither et al., 1995; Walker & Smither, 1999). However, they can easily find excuses to ignore the critical feedback (London & Smither, 2002; Smither et al., 2005). Even the students who want to improve are often confused about the exact corrective steps they need to take, not knowing why they received the critical feedback in the first place. The PE feedback sessions devised in this study were beneficial in that they ensured that all teams had an open and honest discussion – something most teams would have avoided, according to the exit survey. The students who received lower PE scores clearly benefited from the discussion, as several of them acknowledged during the interviews that they did not realize their teammates perceived them as underperforming. Even though the higher scoring students had less room for improvement, the interview analysis shows that the feedback sessions were beneficial to them as well, because they received recognition for the quality of their work in front of the entire team and felt appreciated by their teammates. Therefore, although it may be tempting to focus on the most troubled students or dysfunctional teams only, it is beneficial to provide all teams with detailed and developmental feedback that can enhance their team development and learning.

Whereas it is well established that feedback is critical for learning and skill development in teams (Gabelica et al., 2012), providing constructive feedback that is taken seriously by students and leads to improved behaviors and outcomes is not an easy task for management educators. Incorporating a dedicated feedback session as a part of the class, as done in this study, serves the triple purpose of: 1) allowing students to take the time to understand and reflect on the feedback they gave and received; 2) stimulating in-depth, constructive discussions to generate actionable steps for improving individual contributions; and 3) prompting students to reflect on and improve their teams' internal processes.<sup>7</sup> Although this method requires some dedicated class time plus extra effort to prepare

<sup>7</sup> The semi-private feedback sessions discussed in this study are face-to-face, whether in a physical classroom or in an online format (e.g., via breakout rooms in Zoom).

the feedback for sharing with student teams, the benefits in terms of student engagement and reflection fully justify the effort. In addition to the learning benefits and direct improvement in teamwork skills, the experience of discussing critical feedback in teams and being able to face criticism from teammates can benefit students in their future professional careers.

It is also essential that the instructor put the teamwork into perspective, by explaining to students the benefits of teamwork and PEs for their overall professional development, beyond the scope of the current class. The feedback provision gives students first-hand experience into real-world interpersonal interactions and job evaluations, which can have a lasting impression on them. One of the students interviewed reflected on the feedback session by saying: "It's realistic anyway. If you get a 360 or something like that, you're going to be subject to some kind of peer review anyway. You might not know who is leveling criticism at you, but you can expect things like that in the real world. It's just something that's going to happen." If students understand that the feedback session is not just addressing issues on their current teams but also preparing them for the workplace, it helps put the scores in perspective and makes them more open to feedback.

### 5.2. *Influencing the teamwork processes*

This study also highlights the role that team processes play in facilitating (on inhibiting) students' improvement in teamwork effectiveness. For example, the robust effect of task conflict is not surprising in light of recent developments in the team literature that has consistently shown that task conflict can be beneficial for team performance under the right circumstances (de Wit et al., 2012). To ensure that student teams maintained a healthy level of task conflict, these benefits were discussed in class as part of the course content. Further, students were repeatedly encouraged by the instructor to push each other and critically analyze all ideas. Such simple steps can be very effective and are easy to implement in the context of any class.

The weak effect of process conflict observed in this study is likely due to the fact that all teams had created and signed team contracts at the beginning of the semester, which they also had to revise in the fourth week of the semester. The contracts were required to include team procedures (e.g., meetings, management and communications inside and outside of class, decision-making, and setting deadlines), team expectations (e.g., work quality, distribution of tasks and responsibilities, rewards, and sharing of ideas), and team consequences (e.g., enforcing accountability, distribution of team points among members, and seeking intervention from the instructor). These detailed contracts may have left little room for process conflict, as evident by the team-level data. In other classes where such a clear upfront agreement on team processes is not required, it is likely that process conflict has a stronger influence on student improvements in teamwork effectiveness.

Further, the fact that nearly all of the students interviewed discussed some of their teams' processes suggests that there are pedagogical benefits of explaining to students the importance of team processes such as different types of conflict, interdependence and cohesion. In this study, students were familiar with the team processes conceptually but some did not internalize how critical they were in accomplishing the teams' goals. Further, none of the teams had a clear idea how their processes compared to those of other teams, until the feedback session where the instructor brought to their attention anomalies in their team processes. For example, some teams were surprised that their relationship conflict was much higher than other teams, while others did not realize that their level of task conflict was so low that they were likely lacking constructive discussions. Given the role that team processes play in facilitating (or impeding) improvement in individual team-members' effectiveness, it is important for instructors to build into their classes some guidance for students on building functional and supportive team processes. Further, online teamwork evaluation systems like CATME make the assessment of team-level processes fast and convenient for the instructor, who can easily download and use the aggregated team-level data.

### 5.3. *Teamwork assignments design*

Finally, it is important for educators to consider the benefits of designing teamwork assignments that require higher levels of interdependence among team members and provide iterative opportunities for students to improve on their teamwork effectiveness. The team projects and assignments described in this study offer examples of demanding assignments that are complex enough to ensure that teammates interact extensively outside of the classroom in order to complete them. Making the team projects highly consequential is also important, as it motivates students to take seriously both the teamwork and the PE feedback they receive. Depending on the class, multiple team-based assignments should be considered, as a way to give students multiple opportunities to practice and improve their teamwork skills.

### 5.4. *Future research*

The study results show the importance of both individual and team-level factors for students' improvement in teamwork effectiveness, as well as the differences among the five dimensions of teamwork effectiveness in terms of which factors influence improvements along each dimension. Future research can extend the study by further exploring how these factors may play out in other contexts, such as more homogenous classroom environments, classes in other management areas and beyond, and graduate classes. Also, it would be interesting to examine potential interactions between individual and team-level factors, as well as possible self-perpetuating or diminishing returns on some of these factors over multiple semesters.

## Author statement

Antoaneta Petkova: Conceptualization, Methodology, Formal analysis, Writing-Original draft preparation, Supervision.  
 Monique Domingo: Methodology, Formal analysis, Writing-Review & Editing, Investigation.  
 Eric Lamm: Conceptualization, Writing-Original draft preparation, Supervision, Project administration.

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