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REVIEW

A Practical Review for Implementing Peer Assessments Within Teams

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Objective. The objective of this review is to maximize the benefit of peer assessments in teamwork settings in professional pharmacy curricula.

Findings. Best practices do not exist for using peer assessments in academic settings. The studies on peer assessments that we reviewed applied various conditions: Some studies used peer assessments of teams for formative assessments, while others used them for summative assessments; some assessed teamwork at a limited number of time points, while some assessed multiple time points; some attached student names to the assessments, while some were anonymous; and some explained why the tool was being used, while others offered no explanation.

Conclusion. To use peer assessments most beneficially, instructors must define the purpose for their use, explain the purpose of teamwork, orient students to the tool being used, assess teamwork over time, provide feedback, minimize grades associated with the assessment, and use partial anonymity when collecting feedback.

Keywords: peer assessment, collaboration, teamwork, CATME, group work

INTRODUCTION

Many disciplines have long debated whether peer assessments of teamwork should be used as a measure of performance, contribution, and feedback. Within education alone, many literature reviews of peer assessments of team and group work exist.[1-6] Proponents of such assessments cite that they help hold individuals accountable for their own contributions to the team, increase engagement among team members, and ultimately contribute to better learning outcomes.[7] A recent meta-analysis of 55 articles related to peer assessments of teamwork found strong evidence that the use of these assessments within courses coincided with improvements in academic performance.[5] Despite these findings and the many perceived benefits of peer assessments, numerous challenges remain in administering them, including reliability and fairness.[8] In addition, logistical concerns include the time burden on faculty members, student response and frequency, and grade allotment. Given the increased emphasis on providing team-based health care along with supporting literature demonstrating improved learning outcomes of working in teams, health care educators should be encouraged to focus on building "team players."[9,10] Within pharmacy specifically, peer assessments (when administered appropriately) could serve as a tool to provide feedback to individual students, help them learn and practice team-based principles in a low-stakes setting, and improve the "soft skills" they will need to lead a successful career in pharmacy. As such, having consistent guidance regarding peer assessments and their use across the curriculum would be beneficial. Further, widespread distribution of techniques and best practices for the use of these assessments in teams may help ensure that the purpose of the assessments are being achieved.

Peer assessments on teams have been identified as one of the core elements of team-based learning and are already frequently used in pharmacy, health professions education, and many other fields.[11] In addition to team-based learning, various forms of learning, such as problem-based learning, collaborative learning, and cooperative learning, may warrant the use of these assessments. However, despite the ubiquity of such assessments, there is no consensus on best practices for how to use or implement them.[3] A wide variety of peer assessment tools are available, yet many institutions continue to develop their own. When working to develop a validated peer assessment tool, Freeman and colleagues found that peer assessment schemes tend to differ on four main factors: whether a self-assessment is used in combination with a peer assessment; whether the assessment uses holistic criteria or multiple criteria for assessing

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teamwork; whether the criteria reflect task or teamwork elements or a combination thereof; and whether the mathematical formula used to calculate results uses weighting factors.[12] Evidence suggests that numerous factors affect the quality of peer assessments, including the reliability of the instrument, its use in different peer-to-peer interactions, and the stakes of the evaluation.[13] These factors not only impact the quality of the evaluation, but they can also impact its efficacy.[13] Therefore, an inherent limitation of peer assessments, across all disciplines, is how to create and administer a high-quality, reliable tool. The purpose of this review is to suggest best practices for applying peer assessments on teams using literature from a variety of disciplines.

Before we discuss the best practices for applying peer assessments to teams, we briefly review their benefits and limitations. Sufficient evidence suggests that team-based learning, peer-to-peer teaching, and collaborative learning enhance students' knowledge and critical thinking skills.[14-18] For these reasons, many schools of pharmacy have integrated these methods of active learning into their curricula. An evaluation in 2013 demonstrated that over one-third of schools of pharmacy in the United States had implemented components of team-based learning[9]; that number is likely much higher now. In addition, the same faculty that were surveyed indicated that they perceive team-based learning to be more effective than traditional lectures at fostering learning in all six domains of Bloom's taxonomy.[9] Outside of educational outcomes, the push toward value-based health care emphasizes collaboration and the use of interprofessional health care teams, which have been shown to improve a variety of heath care outcomes and decrease health care costs.[19] The latest standards of the Accreditation Council for Pharmacy Education (ACPE) require that curricula prepare students to be contributing members of health care teams in a variety of settings.[20]

A review of the literature revealed that peer assessments on teams are associated with both positive and negative outcomes (Table 1). The first positive outcome is that peer assessments reduce "social loafing," which refers to the concept that people are more likely to exert less effort when working collectively as a group compared to when performing work individually[21,22]; social loafing can be detrimental, as it can reduce productivity because individuals are working below their fullest potential.[21,22] Because each team member's contributions can often be difficult to determine, peer assessments can reduce social loafing, as team members are held accountable for their individual work, which can ultimately increase responsibility and team effectiveness.[23] Second, when students are aware of impending peer assessments, this can affect their behavior and dialogue when working with teammates. As such, students could become more cognizant of contributions from their teammates and ensure they are not underperforming.[24] Third, course grades and individual project grades seem to correlate with team functionality, with better-performing teams leading to higher team grades and performance.[7,25] Finally, using peer assessments also helps students develop skills in providing feedback and, potentially, in conflict resolution.

Despite these benefits, not all peer assessments have suitable reliabilities.[13] Other limitations of peer assessments include concerns of quality regarding fairness, validity, and accuracy.[1,26] Further, because students may be concerned about an upcoming evaluation by their peers, they may

Table 1. Peer Assessments by Team Members Are Associated With Positive and Negative Outcomes as Reported in the Literature

Outcome	Literature summary
Positive outcomes	• Reduced social loafing: individual responsibility and team efficacy encouraged[23] • Improved course and individual project grades[7] • More student-centered learning environment[7] • Enhanced level of care, impression management behaviors, perception of contribution from teammates[24] • Positive formative effects on student achievement and attitudes[25]
Negative outcomes and limitations	• Time intensive for both students and faculty[11] • Highly variable quality; depends on instrument reliability, peer-to-peer interactions, and stakes of evaluations[13] • Questionable fairness, reliability, validity, accuracy[1,26] • Priority placement on impression management rather than meaningful contribution[24] • As summative assessment, can inhibit good judgment (students tend to be overly generous)[27]
Neutral outcomes	• Evaluation scores modestly predict student performance on other measures (quizzes, standardized tests, etc)[51]

spend more time focusing on making a positive impression rather than making meaningful contributions.[24] Additionally, biases may arise if peer assessments are linked to students' final grades. Results from Sridarhan and colleagues found that students tended to be overly generous when assessing their peers when the evaluations were incorporated to their final grades, with more pronounced bias in underperforming students.[27] Ultimately, despite potential limitations, considerable literature suggests that peer assessments are beneficial and lead to improved outcomes and skills when administered thoughtfully and accurately, which includes implementing safeguards or best practices against the inherent limitations of peer assessments.

Assessment Tools, Evaluation Components, and Administration Conditions

Because many researchers and educators have customized their own peer assessment metrics, no consensus exists on a universal tool that can be used in a standardized manner.[28] However, various published tools exist, and here we focus on the most commonly used and validated instruments (Table 2); the following is by no means an exhaustive list. The Comprehensive Assessment of Team Member Effectiveness (CATME) is an instrument that collects behavioral data on teams in five areas that research has shown to be important: contributing to the team's work, interacting with teammates, keeping the team on track, expecting quality, and having relevant knowledge, skills, and abilities.[29] The TEAM UP and TEAMQ tools, which have been found to be effective, focus on the five domains of teamwork: project planning and management, fostering a team climate, facilitating the contribution of others, managing conflict, and contributing to team projects.[30] The tool Peer Assess Pro (Peer Assess Pro Ltd) allows respondents to give an overall recommendation and describe task contributions, and it also highlights leadership and team processes. Tools that can be further customized include SPARKPLUS (SPARKPLUS Hosting and Support) and TEAMMATES. SPARKPLUS is a web-based self- and peer assessment tool students can use to negotiate the strategy they will use as a team to best achieve their results through equal contributions and improved learning outcomes.[12,31] This tool can be customized to select tasks and attributes to be assessed in students' individual work and that of their peers. TEAMMATES provides flexible feedback methods with various visibility control and generates downloadable reports and statistics. Instructors can customize their peer assessments to include multiple choice questions, numerical scales, and free-text comments.

Peer assessment tools must consider certain components to be the subject of assessment; the most common of these components are listed in Table 3 and fall into three categories: team members' task contribution and reliability, interpersonal skills, and leadership. When deciding on what components to include, one can employ one of three approaches. The first approach is to use an already developed tool (Table 2), as these already identify important component pieces. The second is to start with an already available tool (Table 2) and customize it based on the needs of the learning environment. Some commercial products do allow customization (eg, SPARKPLUS and TEAMMATES). The third is to establish an assessment de novo. The advantage of using a previously available instrument is that minimal development is necessary, and the tool may already be valid or reliable, with prior literature to compare performance. The disadvantage is that the validity and reliability may not be able to be generalized to the learners in which the instructor is applying the assessment. For example, if the tool was validated on undergraduate students, it may not necessarily apply to professional students. The issues of validity and reliability may be less important if the tool is being used for formative feedback with multiple sample points, but these issues become increasingly important for more scholarly pursuits. In contrast, establishing a customized instrument allows students to voice an opinion on their values, which can help with motivation (see self-determination theory) and buy-in, as the students help form the rules for classroom management.[32-35] Creating an evaluation tool de novo also may minimize costs as previously established, and validated tools may require subscription or purchase for use.

In addition to determining what a peer assessment should assess, consideration must be given to the timing and frequency of administering peer assessments. Table 4 provides a summary of the published literature that includes details on peer assessment administration considerations. To alleviate potential barriers associated with peer assessments, they could be implemented early and include multiple evaluation points.[21] Students who are exposed to peer assessments at the beginning of their teamwork have the opportunity to determine their individual roles and future contributions for the group.[36-38] However, peer assessments should not be given solely at the beginning of teamwork, as this could lead to students' waning motivation and may decrease opportunities for personal development. Instead, providing multiple instances of peer assessment may allow students to recognize areas of improvement necessary to achieve success. Feedback throughout group work fosters open communication, whereby participants can reflect on their own roles and contributions along with assessing their peers and the group's success overall.[36] Ultimately, early introduction to peer assessment along with multiple evaluation checkpoints may lead to increased reflection and

Table 2. Commonly Used Tools for Peer Assessment

Available tools	Synopsis of tool
CATME	Web-based instrument that collects data on team member effectiveness in five areas: • Contributing to team's work • Interacting with teammates • Keeping team on track • Expecting quality • Having relevant knowledge, skills and abilities
SPARKPLUS	Customizable web-based self- and peer assessment kit • Allows academics flexibility to choose/create specific targeted criteria to allow any task/attribute development to be assessed ○ Professional skill examples: enthusiasm and participation, team organization, idea contribution, problem-solving, efficiency, conflict management, constructive feedback, reliability ○ Task-specific performance examples: evaluating performance by breaking down assignment/ semester into smaller parts • Allows students to self- and peer assess individual work and improve their judgement through benchmarking exercises • Automates data collection, collation, calculation, and distribution of feedback of results • Anonymous written feedback to peers
TEAM UP & TEAMQ	Assesses five domains of teamwork skills • Project planning and management • Fostering a team climate • Facilitating the contribution of others • Managing conflict • Contributing to a team project
TEAMMATES	Customizable, automatically generated components • Member contribution • Comments about their own contribution • Team dynamics • Feedback to each teammate
Peer Assess Pro	• Overall recommendation • Task contribution ○ Initiative ○ Attendance ○ Contribution ○ Professionalism ○ Ideas and learning • Leadership and team processes ○ Focus and task allocation ○ Encourages contribution ○ Listens and welcomes ○ Conflict management and harmony ○ Chairmanship • Developmental feedback ○ Qualitative, highs/lows • Teacher advice

communication, task motivation, and cohesion and can decrease social loafing.

The next issue in implementation is maintaining the integrity of peer assessments through anonymity. Studies have found that peers may be hesitant to evaluate each other and would prefer to remain anonymous.[28] Various factors can bias peer assessments, such as friendship, peer pressure, ego, age, and self-esteem.[2,39] To promote accurate and constructive feedback for themselves and their peers, students should feel reassured that their evaluations are confidential and secure. Advancements in modern technology have simplified the anonymity of administering

Table 3. Common Components of Peer Evaluation Instruments

Component of peer assessment	Metrics within component
Task contribution and reliability	• Percentage of work done • Relevant knowledge, skills, abilities • Contribution of ideas, innovation • Problem-solving and constructive feedback • Attendance and punctuality • Quality control • Efficiency • Focus
Interpersonal skills	• Teammate interaction • Enthusiasm • Participation • Conflict management and resolution • Fostering a team climate • Harmony • Listening and welcoming
Leadership	• Keeping team on track • Encouraging excellence • Facilitation of others' contributions • Task planning and management • Chairmanship
Summative measures	• Overall score • Overall recommendation • Qualitative, developmental feedback (strengths, weaknesses)

peer assessments, protecting the identities of both the assessors and assessees.[40] However, limitations exist when peer assessments are fully anonymous; for example, anonymity might encourage unfavorable behavior by group members, as students may choose to tolerate their teammates' bad behavior in the short-term with the intention of penalizing the underperformers in the final peer assessment.[41]

Another condition to consider when administering peer assessment of group work is whether a grading scheme will be included to combat inequitable peer contributions.[42,43] Peer assessments can measure group members in a formative or summative manner, where formative peer assessments allow individuals to self-reflect on their individual and teammates' work and behaviors along with identifying areas of improvement to ensure their grade accurately reflects their efforts. Formative functions can facilitate conflict resolution, team dynamics, and overall productivity within a group. By contrast, summative peer assessments are used by instructors to rate students' performances; thus, instructors use peer assessment information in assigning individual course grades.

A study conducted by Sridharan and colleagues showed that overall, students had the ability to evaluate their peers with accuracy and consistency in an unbiased manner when their feedback did not count toward the final grade.[27] For formative assessments, students judged their peers more honestly, but students were overly generous when evaluations were attached to a grade. In summative assessments, students' evaluations of their peers showed a dramatic inflation and inability to differentiate high-contributing students from their counterparts when grades were associated.[27] Therefore, prior to administering a peer assessment, strategies must be outlined to mitigate bias, such as appropriate policy measures, peer assessment training, incentives, and penalties. Students must be made aware in the syllabus and in lectures how peer assessments will be used for individual grades, as students' active participation and meaningful input are pivotal in ensuring the assessments' validity and reliability.[42,44] However, students and instructors alike must also understand that a single numeric value cannot accurately capture one's degree of competency for a complex skill such as teamwork.[45]

Recommendations

Based on a review of the literature, we make several recommendations about administering peer review of teams (Table 5). A peer assessment can be an informative tool that encourages students to be held accountable for their individual and collective contributions to a team. While no universal tool exists to execute peer assessments, online systems may be used for more accurate peer assessments.[46] Evaluation tools should cater to specific goals that the course director hopes to achieve through the assessment. Feedback may be customized to provide timely and insightful evaluations of team members' interpersonal and team skills and to encourage individual accountability, which can ultimately prevent social loafing and promote the development of effective teams.[11] Michalsen and Fink emphasize that a peer assessment system must be capable of accommodating different team sizes, must accurately reflect the work of team members, and must make a strong impact on the course grade.[11] Peer assessments can be structured such that participants not only receive constructive feedback but also give feedback, as both receiving and providing instructive feedback influence students' continual progress.[11]

When instructors opt not to use previously established peer assessment tools, they may consider using a formative structure for evaluations, such as the "keep,

Table 4. Selected Studies Demonstrating the Variability in Peer Assessments of Teams

Ref	Population, frequency and timing	Tool used	Anonymity
21	Students in a required, introductory, cross-disciplinary business course. Students were evaluated every four weeks at the end of modules following team project and presentation, three times during the semester.	Custom peer assessment tool determined weight of overall group score allotted to each student. Tool consisting of attendance, punctuality, equal workload, enthusiasm, and attitude.	Anonymous when shared with group members
44	Full-time faculty of a small university evaluated annually at an unspecified time.	Custom tool consisting of unweighted performance criteria: professional development, cooperation with colleagues, teaching effectiveness, contribution to organizational objectives considered in annual evaluations.	Unspecified
36	Students in a required introductory organizational behavior course. Students were evaluated on a questionnaire two weeks prior to the peer appraisal, one week prior to appraisal, immediately after appraisal, and three class periods after appraisal. Peer appraisals were performed six to seven weeks after group formation, variable timing relative to group presentation.	Ungraded conglomerate of previously validated scales measuring open communication, task motivation, group viability, group cohesion, satisfaction with group, and social loafing.	Anonymous
23	Students in a freshman-level, required engineering graphics course evaluated once following completion of group project.	Previously developed ungraded instrument designed to assess work-related categories (quality of work, quantity of participation, timeliness, level of work), and measure student contribution to the project.	Unspecified
51	Students participating in psychiatry six-week clinical clerkship and engaging in team-based learning evaluated during each clerkship cycle. Unclear number of iterations.	Each student was given a supply of 10 points per teammate and instructed to assign the points to the other members based on how they felt the members had contributed to their learning and/or group's performance. Six out of eight student groups chose not to have the evaluation count toward their grade.	Anonymous
40	Preservice teachers enrolled in a technology application course evaluated once following drafting of assignment and attending peer assessment training. After receiving feedback, students revised and submitted the assignment.	Self- and peer assessment tool using assignment rubric to evaluate other students' performances on a specific deliverable. Quality of peer review was considered for class participation grade.	Study assessed both anonymous and named evaluations
7	Students in a freshman-level design thinking course evaluated once during each of the three major project deliverables and twice during the early stages of the final project. Evaluations were timed such that students had the opportunity to receive the feedback prior to engaging in the next main deliverable.	The CATME tool was used, and students were trained on how to give and receive feedback and interpret results. Evaluations were not incorporated into student grades.	Unspecified
37	Corporate managers were rated by subordinates; they were evaluated four times during an upward feedback program.	33 behavioral statements reflecting boss/subordinate relationships across nine different performance categories. Unspecified whether evaluations were considered in performance evaluations.	Unspecified but participants received custom reports

Table 5. Recommendations for Implementing Peer Assessments of Teams

Recommendation
Orientation
Define the purpose of peer evaluation
Explain purpose of teamwork and set expectations
Orient students to the tool
Implementation
Have multiple assessments over time
Use the same tool throughout the curriculum
Provide feedback
Minimize grading
Use partial anonymity

start, stop" method or narrative feedback.[4,47-50] Crucial to the value of peer assessment activities is adequate orientation and training of students to the tool being used. Without thoughtful training in how and why peer assessment is being implemented, the quality of the feedback given and, thereafter, the impact of the exercise overall, is compromised. Student pharmacists should be trained to be selective with feedback, focusing on the one, two, or three most important areas for improvement rather than diluting the impact of their feedback by listing every detail that can be improved upon.

Whenever peer assessment is used, students should be oriented to the purpose of the assessment and to the tool they will be using. Throughout courses, the frequency of peer assessment should be considered because, as students use peer assessment tools more often, they become more familiar with the tool and provide better feedback more efficiently; this is especially useful when peer assessments are being used as a summative assessment at the end of a course. Instructors should also consider the advantages of using formative peer assessments during important milestones within a given course. Additionally, using the peer feedback they receive, students can adjust their performance throughout the course to maximize their potential.[7] For these reasons, the same peer assessment tool should be used throughout the curriculum. Yet, the potential benefits of more frequent peer assessments must be weighed against the time and energy required by faculty and students to coordinate and complete the evaluations. Online tools and software are useful for minimizing this time burden.

Regarding timing, no strong evidence exists to indicate the optimal time at which to conduct a peer assessment. Some studies suggest that earlier exposure to peer assessment allows students to acclimate better to the process of both evaluation and overall teamwork.[36-38] There is, however, no clear indication of when might be the best time to conduct an initial peer assessment, or when might be too early for students to provide their peers with fair and accurate evaluations rather than shallow first impressions. When considering timing, one must decide whether to allot class time to peer assessments or administer the evaluations outside of the classroom. If the latter route is taken, then an appropriate amount of time between administration and due date must be given and should consider the overall workload or exhaustion students may be experiencing at a given time in a semester.

Anonymity has several advantages in peer assessments but eliminating anonymity or opting for only partial anonymity may promote responsibility and professionalism. Rather than guarantee anonymity, instructors may consider requiring students to turn evaluations in with their names attached, with the promise of blinding evaluations prior to distributing them to the person being evaluated. This strategy allows for the accuracy and constructivism of anonymous feedback while promoting professionalism and integrity, as the students will be aware that the instructor will know what each student wrote. Other strategies include requiring students to discuss their feedback with their group members, whether or not the written evaluation was anonymous. As health care professionals in training, student pharmacists must learn how to handle difficult conversations. A face-to-face discussion addressing feedback allows students to own their comments but engage in a productive conversation to promote progress and growth individually and as a unit.

Finally, instructors must decide whether incorporating peer assessment scores into students' overall course grades is a worthwhile strategy to reduce social loafing or whether doing so risks compromising the integrity of the evaluations themselves. Potential strategies to address this dilemma include combining formative and summative peer assessments, requiring written justification of scores given to peers, and placing a maximum value on the grade weight of the peer assessment.[7,11] By practicing providing feedback in a formative way throughout a semester or project, students can improve their feedback skills and comfort with the task as well as adjust their own practices prior to completing evaluations that count for a grade. Written justifications with concrete examples, though they may introduce more work for both students and course instructors, minimize the risk of falsely inflated peer assessments due to worry over costing a classmate a grade. By capping the potential impact of peer assessment on a student's final grade, students may feel less burdened by that worry.

CONCLUSION

Overall, the literature offers no optimal composition, length, frequency, timing, anonymity, or grading strategy for peer assessments. The overall recommendations

summarized in Table 5 aim to initiate the discussion of best practices for peer assessments in professional pharmacy curricula, as the lack of guidance in this space creates an exciting area for further research and experimentation. Further study into each of these areas is needed to develop more concrete recommendations for universal implementation.

With the clear trend in pharmaceutical education moving toward the use of teams in educational settings, practices must be implemented that promote the equal contribution of individuals within teams and the development of strong teamwork skills. Similarly, as the provision of health care continues to become more interdisciplinary and collaborative, pharmacy graduates need to be effective team members upon entry to the workforce. Peer assessments are an important practice to promote accountability, teamwork, and the ever-challenging skills of both giving and receiving constructive feedback.

Although no universal guidance exists for peer assessments, particularly in pharmaceutical education, this means that such assessments can be broadly customized and their use can be maximized, when planned thoughtfully. Implementing goal-centered peer assessments with proper orientation to the tool, strategic timing and frequency, and thoughtful use as a grading mechanism can help facilitate the development of crucial teamwork skills in student pharmacists.

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