REVIEW OF

Research on Teaching Collaboration

SkillPlan

Canada

SRDC·SRSA
SOCIAL RESEARCH AND DEMONSTRATION CORPORATION
SOCIÉTÉ DE RECHERCHE SOCIALE APPLIQUÉE

The following reference document provides a brief review of academic research and relevant reports on best practices for teaching and assessing collaboration skills. The purpose of this research was to support the development of the Skills for Success Practitioner Competency Framework and was part of a series of research reviews on best practices for teaching each of the Skills for Success. This summary provides an overview of evidence-based teaching methods in the area of collaboration, key considerations when applying these practices, and a list of resources for further consideration.

METHODOLOGY

Several search queries were conducted on Google and Google Scholar using combinations of the following keywords: collaboration, teamwork, best practices, teaching, teaching approaches, teaching strategies, pedagogies, instruction, effectiveness, outcomes, evaluation, 21st century skills, 21st century competencies.

Given the limited information on collaboration in adult and workplace-specific contexts, the search was broadened to include reports from all education levels (elementary, secondary, post-secondary).

STATE OF THE LITERATURE

The field of 21st century skills and competencies, including collaboration, is a recent area of empirical research. As a result, there is limited evaluative evidence on best practices in teaching collaboration, assessing collaboration, and a limited understanding of how collaboration skills develop over time.

There are a few recent literature reviews that summarize the state of knowledge on teaching collaboration skills, namely the reviews authored by Lai (2011), Lai et al. (2017)[1], and Evans (2020). This summary report draws heavily on these papers as they best capture the current state of the literature.

Given that research on collaboration as a teachable skill is in its early stages, this review draws on findings from related areas, such as negotiation skills (Schellens et al., 2005, as cited in Evans, 2020).

CONCEPTS

The definition and integral constructs of collaboration as specified in the Skills for Success Framework are described below (SRDC, 2021):

DEFINITION:

"Your ability to contribute and support others to achieve a common goal. For example, at work we use this skill to provide meaningful support to team members while completing a project."

CONSTRUCTS:

- Work well with people
- Value diversity and inclusivity of others
- Manage difficult interactions with other people
- Facilitate an environment where you can collaborate with others
- Achieve a common goal with others
- Reflect and improve on how well the team works together

---

[1]   See Appendix 1 for a summary of conclusions and implications drawn from Lai et al. (2017).

It is also important to distinguish collaboration from other similar concepts such as cooperative learning and "parallel work", as well as to emphasize that collaboration is a skill in and of itself rather than simply as a means to acquire other skills/knowledge.

Cooperative learning is a method for teaching a range of academic skills, whereas collaboration is better understood as "a constellation of knowledge and skills including the ability to work effectively in diverse teams, assuming shared responsibility, and other characteristics…" (Lai et al., 2017; p.?).

"Parallel work" is different than collaboration in that it involves the division of tasks between team members, who then work on their tasks separately before assembling the final product (Evans, 2020). There is recognition, however, that some degree of division of labour and coordination of work processes are important, ongoing aspects of collaboration (Dillenbourg, 1999, as cited in Evans, 2020).

The Skills for Success Framework also distinguishes between understanding collaboration as a skill in of itself, rather than a means to acquire other skills/knowledge. Collaborative actions and processes are the primary learning objectives, and collaboration is not simply used as a mechanism to teach other subject matter (e.g., learning via groupwork) (Evans, 2020).

APPROACHES TO TEACHING COLLABORATION SKILLS

Intervening factors associated with the development of collaboration skills

Collaboration is an interpersonal competency that interrelates with other skills, such as communication, critical thinking, creativity, metacognition, self-direction, motivation, project management, etc. (Evans, 2020). Research has shown that collaborative learning may stimulate critical and creative thinking (Lai & Viering, 2012, as cited in Evans, 2020).

Culture has an important influence on the nature of collaboration, such as the role that social customs play in how people negotiate and resolve conflict. However, more research is needed to understand the relationship between culture and collaboration (Evans, 2020). Instructional designers and practitioners should therefore be mindful of current knowledge gaps when developing and designing collaborative activities catered to the Canadian workforce, which is culturally diverse.

Attitudes toward collaboration are also important. For example, people who show more favorable attitudes with collaboration perform better on the OECD's collaborative problem-solving assessment. Instructors might consider designing activities that prompt open discussion, as students who are regularly asked to discuss their work in class are more likely to have favorable attitudes toward collaboration (OECD, 2015).

Research suggests that **relationships and the valuing of relationships are foundational to effective collaboration.** When students, teachers and parents know each other, trust each other, work together, and share information, ideas and goals, students are more likely to thrive, particularly those

who are most disadvantaged (Crosnoe, Johnson and Elder, 2004; Hughes and Kwok, 2007; Jennings and Greenberg, 2009; as cited in OECD, 2015).

Collaboration is contingent on particular environments or contexts. Though individuals bring their unique collaborative skills to a situation, the nature of their workplace or context may play an important role in the realization of those skills. Environmental factors were not a key area of focus for this review but are nevertheless important to consider when teaching collaboration skills.

Gratton and Erickson (2007) list the following **key factors for creating collaborative work cultures**:

- Building bonds between staff;

- Role modeling of collaboration amongst management;

- Training in relationship skills;

- Building a sense of community.

The following are **learning processes that are involved in collaboration**, and teachers can listen to group conversations to determine whether the collaborative activities are producing these types of interactions (Barron et al. 2003, as cited in Evans, 2020):

1. Share original insights;
2. Resolve differing perspectives through argumentation;
3. Explain ones' thinking about a phenomenon;
4. Provide critiques;
5. Observe the strategies of others;
6. Listen to explanations.

Social skills are integral to collaboration. Therefore, the exploration of interventions that augment social skills may help to develop higher-ordered skills, such as collaboration. Research that compared interventions to improve social skills for those who have deficits showed that coaching, modeling, and mixed model approaches were more effective than no intervention (Gresham & Nagle, 1980, as cited in Lai et al., 2017).

Johnson and Johnson (1994, as cited in Evans, 2020) suggest that the following **five mediating factors are central to developing collaborative skills**.

FACTOR	DESCRIPTION
Positive interdependence	The group sinks or swims together; no one can succeed unless everyone succeeds.
Individual accountability	Each student is held responsible by group members for contributing one's fair share to the group's success.
Promotive interaction	Each student encourages and facilitates each other's effort to complete tasks and achieve in order to reach the group's goals.
Social skills	Students must be explicitly taught and motivated to use the interpersonal and small group skills necessary for high-quality collaborative activity.
Group processing	Groups periodically reflect on how well they are functioning and, as necessary, adjust work processes to enhance collaboration.

Evidence and suggested teaching practices for the development of collaboration skills

While there is a lack of evaluative research on best practices in teaching collaboration skills, there is evidence that suggests that **collaboration skills need to be explicitly taught.** Consequently, instructors and students should not expect these skills to develop naturally through activities such as group work (Lai et al., 2017).

Andrusyk & Andrusyk (2003, as cited in Lai et al., 2017) suggest that teachers teach the following **four features of collaboration** in grade school:

- Group listening skills;

- Encouragement of teammates;

- Disagreeing appropriately and avoiding "put-downs";

- Resolving conflicts.

There are several studies that examine **the effectiveness of interventions to improve teamwork and collaboration skills in higher education**. Chen et al. (2004) evaluated a course on teamwork skills for the workplace and showed that students in the course (treatment group) were better able to acquire teamwork knowledge than those who did not take the course (i.e., the control group). Components of the course included:

- Explicit teaching of teamwork skills and collaboration strategies;

- Use of in-class team activities for one to two hours every week;

- Completion of three assessment-center exercises that simulate more "real-world" collaboration experiences;

- Student-created teamwork goals and regular monitoring of progress toward those goals;

- A relatively large weight given to the collaborative components in terms of course grade.

A study of post-secondary students showed that **groups collaborated more effectively in interventions where structured guidance was provided** (Rummel & Spada, 2005, as cited in Lai et al., 2017).

Collaborative learning (e.g., group work, cooperative learning) is often used to teach other content rather than to improve collaborative skills specifically. This method appears to have no impact on improving collaboration skills. Rather, **learners make performance or collaborative skill improvements when collaboration skills are modeled or explicitly taught** (Rotherham & Willingham, 2010, as cited in Lai et al., 2017). Teachers can therefore establish and model norms for how the groups should communicate (Gilles et al., 2014, as cited in Evans, 2020), while also providing clear guidelines for group participation (Webb et al., 2014, as cited in Evans, 2020).

Collaboration occurs in particular contexts or in relation to a specific topic area, and discipline-specific or domain knowledge cannot be separated completely from collaborative activities (Lai et al., 2017). As a result, the design of learning activities on effective collaboration should consider aspects of domain or discipline-specific knowledge, particularly given that the quality of student interactions will depend in part on how well the students understand the applicable content area (Evans, 2020).

Johnson and Johnson (1990) **outline the following steps to teach collaboration skills for K-12 students**, though there is a lack of empirical evidence concerning the effectiveness of this approach (Lai et al., 2017):

- Explaining why the skill is important;

- Displaying it on bulletin boards;

- Creating a chart with the physical and verbal actions that are key to the skill;

- Role-playing;

- Group processing;

- Practice.

Dillenbourg (1999, as cited in Evans, 2020) advised that **instruction and assessment should be focused on the following four related factors**.

FACTOR	DESCRIPTION
Type of interaction	Negotiation, conflict resolution
Requirement of the situation for more/less collaboration	Interdependence, interactivity
Effects of collaboration on individuals and group products	Increased learning, reasoning, justification, explanation, quality of final product
Enable cognitive processes	Perspective taking, argumentation, justification, explanation, analysis

To foster collaborative learning, the author suggests teachers carry out the following:

- Carefully set up the initial conditions;

- Assign students specific roles or jobs in the group;

- Scaffold productive interaction by including interaction rules;

- Monitor and regulate the interactions.

There have been studies on what **features related to learning activities may impact the development of collaboration skills**, though improvement in these skills were not measured directly. Lai et al. (2017) provides the following examples:

- **Group Formation**

  - There are mixed findings on the role of group formation. Smaller groups appear less prone to "social loafing", though there is likely not a "best" group size, as it will be context dependent (e.g., task and type of work to be accomplished).

  - There are mixed findings on performance, satisfaction, and the rate of "social loafing" between *instructor-selected* and *student-selected* groups.

  - The ability mix of the group may also impact the effectiveness of collaboration. There is

some evidence that heterogeneous groupings benefit lower-achieving students, while homogenous groupings are of greater benefit to higher-achieving students (Webb et al., 1998, as cited in Evans, 2020). However, there is competing evidence concerning the role of ability mix (Barron, 2003, as cited in Evans, 2020).

  - Research shows that exposure to diversity in the classroom is associated with better collaboration skills (e.g., working with students who are different from each other and who are more likely to hold different viewpoints) (OECD, 2015).

- **Role Assignment**

  - There is evidence that assigning roles to participants in a group can lead to desirable behaviours that better facilitate the group's work. For instance, research shows that those with assigned roles make more "task-coordination comments" and report higher levels of efficiency compared to individuals assigned to the "no roles" group. Nonetheless, there were no significant differences in performance between the two groups (Strijbos, Martens, Jochems, & Broers, 2004, as cited in Lai et al., 2017). Evans (2020) notes that assigning roles, such as "Elaborator" and "Clarifier" may encourage better listening, communication, and understanding between peers.

- **Providing Feedback**

  o Several studies suggest that feedback may be an effective method to improve collaboration skills. For instance, software engineering students in a treatment group that were provided feedback on both their collaboration and programming skills performed better than those who only received feedback on the latter (Baghaei, Mitrovic, and Irwin, 2007, as cited in Lai et al., 2017). The study also found that the students provided with feedback contributed more to the group solution and performed better on a post-test question regarding collaboration behaviours, and that the control group engaged in twice as much off-task discussion latter (Baghaei, Mitrovic, and Irwin, 2007, as cited in Lai et al., 2017). Despite the limitations of the study (e.g., no random assignment of groups), the findings provide further evidence that explicit instruction on collaboration skills is important.

- **Task Structure/Activation**

  o Tasks should be sufficiently complex and authentic (e.g., meaningful, practical, or have real-world significance) to enable effective collaboration and participation of every group member. Problems with single solutions or those that can be solved in a straightforward manner are thus less conducive to meaningful collaboration (Evans, 2020).

ASSESSMENT OF COLLABORATION SKILLS

Lai (2011) notes that in order to measure collaboration skills specifically, **the assessment should focus on gathering evidence to determine the quality of student interactions**, as opposed to the quality or quantity of the product(s) produced by the group.

Evans (2020) classifies the **types of assessments for collaboration into the following five categories**.

ASSESSMENT TYPE	DESCRIPTION	BENEFITS	CHALLENGES	EXAMPLES FROM THE LITERATURE
Self or peer reports	Student self and/or peer report (survey)	Easy and cost effective to administer; could improve group processes, motivation, and engagement	Response set biases such as social desirability bias; susceptible to coaching and faking	(French et al., 2016; Kelley, Knowles, Han, Sung, 2019; Lower, Newman, & Anderson- Butcher, 2017; Wang et al., 2009; Wever, Keer, Schellens, & Valcke, 2011)
Global rating scales	Completed by teachers; asked to rate students' collaboration skills	Provide reliable scoring across students by any one teacher	Time consuming; difficult for teachers to observe and rate all students in their class(es); halo effects; lack of consistent interpretation possible across teachers	(French et al., 2016; Wang et al., 2009)

ASSESSMENT TYPE	DESCRIPTION	BENEFITS	CHALLENGES	EXAMPLES FROM THE LITERATURE
Standardized assessments	Selected and/ or constructed response items, situational judgment tests, computer simulations	Use in large-scale educational applications; provide reliable measures for individuals or groups	Tasks may not mirror authentic scenarios; susceptible to social desirability bias, coaching and faking, and confounding variables (e.g., verbal or reading ability)	(Care et al., 2016; Hao et al., 2019; Liu, von Davier, Hao, Kyllonen, & Zapata-Rivera, n.d.; Scoular, Care, & Awwal, 2017; von Davier & Halpin, 2013; Wang et al., 2009)
Observational measures	Teacher observation of type of talk happening in groups	Based on actual student behaviors (verbal/ nonverbal); related to enacted curriculum	Labor intense; not feasible for large-scale testing	(Garcia-Mila et al., 2013; Mercer, 1996; Rojas- Drummond & Mercer, 2003; van Boxtel et al., 2000)
Performance assessments	Application of knowledge and skills to a new or novel situation	Authentic and more meaningful and engaging for students	Cost; concerns about reliable scoring and generalizability of student scores (task by occasion by student interactions)	N/A

Based on the existing literature, Evans (2020) suggests that the **design of assessments for collaboration** should reflect the following:

- Assessment tasks should be sufficiently complex and offer sufficient challenge to encourage joint, collaborative activity;

- Assessment tasks should include open-ended and/or ill-structured tasks;

- Assessment tasks should be authentic;

- Assessment tasks should reflect how context and culture matter.

Lai et al. (2017) discuss various approaches to assessing collaboration that have shown promise, **including task, evidence and scoring models**. Aspects of the evidence and scoring models reiterate approaches mentioned in Evans' (2020) table above, while providing further detail on behaviours that can be observed as evidence of collaboration.

Task Models: These models are tools that represent aspects of assessment activities or *tasks* that are likely to elicit evidence of the constructs to be measured. For example, research shows that when students were split into groups, those who were given "consensus prompts" engaged in more positive team communication than those given "persuasive prompts" (Garcia-Mila et al., 2013, as cited in Lai et al., 2017). The design of assessment tasks also involves consideration of structural features, such as group size, group composition, and ways to mitigate social loafing.

Evidence Models: These models describe the types of *behaviours* to be measured to assess collaborative skills. There are several challenges in gathering evidence to assess individuals because:

- There is interdependence between collaborating individuals;

- Higher-ordered skills involved in collaboration is often not evident in the *product* but rather emerges from the *process* of producing the product, thus warranting continuous monitoring by the assessor;

- Many of the behaviours assessed are not easily captured by standardized tests (e.g., listening, discussing various points of view, organizing into roles, etc.).

The following table summarizes **studies that have linked behaviours to collaboration skills** (Lai et al., 2017).

BEHAVIORS	SOURCE
Questioning and listening to address miscommunication conflicts, collective brainstorming, searching for common goals, exchanging offers, counteroffers, and concessions to reach compromise, forging of integrative (win–win) solutions, inquiring about others' goals and interest, properly structuring team meetings, soliciting input from everyone, and active listening strategies, such as probing (encourage speaker to clarify meaning), reflecting (paraphrasing a message to ensure comprehension), deflecting (relating analogies and examples to help the speaker understand a problem), engaging in small talk	Stevens & Campion, 1994
Number and type of sentence starters used, asking for help, providing help, providing elaborated explanations	Baghaei, Mitrovic, & Irwin, 2007
Use of different types of sentence starters as indicative of different cognitive levels—e.g., use of reasoning to provide justification for a point of view was valued higher than asking clarifying questions to remember or understand	Gogoulou, Gouli, Grigoriadou, & Samarakou, 2005
Changes or modifies position if a defensible argument is made by another team member, recognizes and praises other team members' efforts, employs "win–win" negotiation strategies to resolve team conflicts, and identifies the important elements of a problem situation	Chen, Donahue, & Klimoski, 2004

BEHAVIORS	SOURCE
Planning and task coordination in the form of the number of times teammates assisted one another by engaging enemy tracks in their teammates' quadrant and evidence of communication skills in the form of the number of times teammates shared task-related information	Ellis, Bell, Ployhart, Hollenbeck, & Ilgen., 2005
Use of rebuttals in argumentative discourse as evidence of "two-sided reasoning," which demonstrates an openness to considering other viewpoints and a willingness to negotiate/make concessions to reach consensus	Garcia-Mila et al., 2013

Scoring Models: these models refer to the means of evaluating evidence of collaboration skills. The main types discussed by Lai et al. (2017) include:

- **Behavioural observation by instructors/ experts.** This approach can be highly valid and reliable but requires considerably more time and resources. Behavioural observation is the most common method of assessing collaboration skills.

- **Peer rating.** This approach has been shown to be as reliable and valid as instructor ratings but can be susceptible to issues such as rating a team member high so that the group gets an overall better grade.

- **Automated systems (technology) that monitor the process and outcomes.** These models can provide some degree of control over the collaborative activity and can reduce the burden on human resources (e.g., time spent observing behaviour). In these models, the events and student actions are logged, and statistical models can be used to analyze the data. The OECD (2015) utilized this type of model in the PISA assessment titled Collaborative Problem-Solving, whereby students interacted with computer agents or avatars. Research has shown that despite students not interacting with other people, simulations can be as reliable and valid as situations involving human-to-human interaction/collaboration (Lai et al., 2017).

Various **learning progression and performance scale frameworks** have been developed to capture the levels of collaboration, including:

- Essential Skills and Dispositions Development Framework (Anderson, 2016);

- Deep Learning Progressions (Fullan et al., 2017; Quinn, McEachen, Fullan, Gardner and Drummy, 2000, as cited in Evans, 2020);

- PISA Collaborative Problem-Solving Framework (OECD, 2015);

- Assessment and Teaching of 21st century skills (ATC21S, 2014, as cited in Evans, 2020).

The Essential Skills and Dispositions Framework[2] was designed to provide teachers with clear guideposts and understanding on how to recognize skill development (Evans, 2020). These frameworks are a helpful starting point, but Care et al. (2018, as cited in Evans 2020) note that the developmental nature of collaboration is limited, and there is no firm evidence describing the progression of how students best achieve mastery over collaboration from less to more sophisticated levels.

---

[2]   https://www.inflexion.org/essential-skills-and-dispositions-development-frameworks/#:~:text=This%20set%20of%20developmental%20frameworks,and%20self%2Ddirection%20in%20learning

The following rubric developed by The American Association of Colleges and Universities[3] benchmarks the following **five levels of performance related to collaboration**.

RUBRIC DIMENSIONS	
Contributes to team meetings:	The benchmark performer shares ideas whereas the capstone performer articulates pros and cons of various alternatives.
Facilitates the contributions of team members:	The benchmark performer shares ideas whereas the capstone performer articulates pros and cons of various alternatives.
Individual contributions outside of team meetings:	The benchmark performer completes assigned tasks by the deadline, but the capstone performer completes tasks to a high degree of excellence and helps others finish their tasks.
Fosters constructive team climate:	The benchmark performer is inconsistent in the use of supportive communication whereas the capstone performer consistently uses supportive communication.
Responds to conflict:	The benchmark performer passively accepts conflicting viewpoints, whereas the capstone performer addresses conflict directly and effectively resolves it.

CONSIDERATIONS FOR TEACHING AND ASSESSING COLLABORATIVE LEARNING

There is evidence that some **faculty in Post-Secondary Education do not feel prepared to teach collaboration skills** and do not feel it is within their realm of responsibility (De la Harpe, Radloff, & Wyber, 2000, as cited in Lai et al., 2017). Similar findings appeared in the review on problem-solving (Jozwiak, 2004). Consequently, it is likely that some practitioners are reluctant to move beyond their comfort zone to teach these new skills, and a

change management approach may be necessary to change entrenched attitudes regarding teaching roles and responsibilities.

A challenge with behavioural observation that received little attention in the literature is the likelihood that students may act differently while being observed by an instructor/evaluator. For instance, it is possible that some students will fear being observed and collaborate less effectively, when compared to instances in which they are not observed. In contrast, it is conceivable that others who are more comfortable or eager to impress may exaggerate their collaborative skills beyond their normal or typical behaviour.

Interventions that have been studied typically include multiple components. It is thus not possible to discern whether the combination of

---

[3]   https://www.aacu.org/initiatives/value-initiative/value-rubrics/value-rubrics-teamwork

components or individual aspects produce the greatest skill improvements in collaboration/ teamwork (Lai et al., 2017).

Evans (2020) notes that **in self-reporting and peer report evaluations, students are more likely to be honest in identifying what they could improve upon, if they knew the information was only going to be used for formative purposes**. However, students may be more biased if they realize their grades (summative evaluation) will depend on self- and peer-reports of their collaborative efforts. Therefore, formative approaches to evaluation/assessment may be a more fruitful means of assessing collaboration, which aligns with a deep research base on the effectiveness of formative feedback on learning (Black and William, 1998, as cited in Evans, 2020; Hattie, 2009).

There is considerable **overlap and interdependence between several of the new essential skills**. The Skills for Success Framework underscores this, noting that as patterns of interconnection between the new essential skills become more clearly understood, learning and assessment materials for these skills can be combined and adapted to develop multiple skill areas simultaneously (SRDC, 2021). Furthermore, the Framework notes that while problem solving, communication, and collaboration have been conceptualized as *skills*, aspects of these skills can be characterized as personal qualities (e.g., concern for others, cooperation, judgement, initiative, attention to detail) (SRDC, 2021). Hence, the complex nature of these skills poses additional assessment challenges compared to traditional skills.

REFERENCES

Anderson, R. (2016). Essential Skills and Dispositions: Developmental Frameworks for Communication, Collaboration, Creativity, and Self-Direction.

Chen, G., Donahue, L., & Klimoski, R. (2004). Training Undergraduates to Work in Organizational Teams. Academy of Management Learning & Education, 3, 27–40. https://doi.org/10.5465/AMLE.2004.12436817

Evans, C. (2020). Measuring student success skills: A review of the literature on collaboration. National Center for the Improvement of Educational Assessment. https://www.nciea.org/sites/default/files/publications/CFA-CollaborationLitReport-FINAL.pdf

Gratton, L., & Erickson, T. J. (2007). Eight Ways to Build Collaborative Teams. Harvard Business Review. https://hbr.org/2007/11/eight-ways-to-build-collaborative-teams

Hattie, J. (2009). Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement. SAGE Publications.

Johnson, D. W., & Johnson, R. T. (1990). Social Skills for Successful Group Work. Educational Leadership, 47(4), 29–33.

Jozwiak, J. (2004). Teaching Problem-Solving Skills to Adults. Journal of Adult Education, 33(1), 19–34.

Lai, E. (2011). Collaboration: A literature review. Pearson. http://images.pearsonassessments.com/images/tmrs/collaboration-review.pdf

Lai, E., DiCerbo, K., & Foltz, P. (2017). Skills for Today: What We Know about Teaching and Assessing Collaboration. Pearson. https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/efficacy-and-research/skills-for-today/Collaboration-FullReport.pdf

OECD. (2015). PISA 2015 Results (Volume V): Collaborative Problem Solving. https://www.oecd.org/publications/pisa-2015-results-volume-v-9789264285521-en.htm

SRDC. (2021). Research Report to Support the Launch of Skills for Success: Structure, Evidence and Recommendations. Final draft report.

APPENDIX

The following table is drawn from Lai et al.'s (2017) review of the literature on collaborative learning, which summarizes their key findings.

Reference: Lai, E. R., DiCerbo, K. E., & Foltz, P. (2017). Skills for Today: What We Know about Teaching and Assessing Collaboration. London: Pearson.

CONCLUSION	IMPLICATION	TIPS FOR CLASSROOM PRACTICE
Collaboration skills are associated with more effective performance at school and on the job, and are highly valued by employers	Educators should develop collaboration skills in students as an end in themselves, not simply as a teaching method by which to learn other skills.	Establish learning objectives for collaboration. Plan for and use group activities as opportunities to reinforce and practice these skills.
The elements of collaboration shared across multiple frameworks include interpersonal communication, conflict resolution, and task management.	When teaching and assessing collaboration, educators should see the skill as multidimensional, looking at the elements both individually and together.	Show and explain what good collaboration looks like. Design activities that require learners to use the elements of collaboration in concert but provide feedback on each element individually.
It is possible to define less and more sophisticated levels of collaboration skill.	Educators should use these levels when assessing and teaching collaboration.	Help learners understand their own skill level in terms of observable behaviors.
There are different types of collaborative tasks that require greater or lesser degrees of collaboration skill.	Educators should select and design the appropriate task type for the situation and the learners.	Make sure group activities require students to work together and negotiate to forge consensus.
Assessment of collaboration requires collecting evidence of group interactions and team processes such as language used for communication, reactions to obstacles, planning documents, and approaches to decision-making.	Educators should capture group interactions and processes either through observation (by the instructor or peers) or by using technology that captures and automatically analyzes verbal communication and group decision-making.	Pick and choose from a diverse mix of evidence, including your own in-class observations, peer ratings, chat logs, discussion boards, email threads, documentation of task planning and organization of labor, and the group product during various stages of drafting, commenting, and revising.

CONCLUSION	IMPLICATION	TIPS FOR CLASSROOM PRACTICE
Collaboration skill does not tend to develop in the absence of explicit instruction.	If students' collaborative skills are to improve, educators need to provide some combination of direct instruction in the skills of collaboration, opportunities to practice collaborating, and feedback.	Spend time in class directly teaching collaboration skills, including strategies for interacting productively with others, resolving conflicts, and managing taskwork.
Peers can reliably rate others' collaboration skill and these ratings can result in skill improvement.	Peer evaluation using defined rubrics or scales can be implemented as part of an effort to increase collaboration skills.	Create your own peer rating scale that aligns to the definition and levels of collaboration and train students to use the rating scale. Model how to provide constructive feedback on collaboration.
Aspects of forming groups (size of the group, group composition, and method of forming groups) may affect students' interactions and experiences. Although students may prefer self-selected groups, group composition is more difficult to control when teams are self-selected.	Generally, educators should use smaller, mixed-ability groups. Educators should consider using self-selected teams for learning activities but instructor-selected teams for assessment purposes.	Rotate groups so that students gain experience working with different types of individuals and teams.
Assigning specific roles (e.g., moderator, summarizer) may be one way of encouraging students to demonstrate desirable collaboration behaviors.	Instructors should experiment with embedding specific functional roles into collaboration tasks, particularly roles that emphasize desirable collaboration behaviors.	Allow students to choose which of the defined roles in a task they would like to play but encourage them to practice playing different roles over time.