

A LITERATURE REVIEW ABOUT ONE OF THE SUCCESSFUL SKILLS OF THE 21ST CENTURY: COLLABORATIVE ABILITY STUDENT

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Abstract: One of the important abilities for students to have and develop is the ability to collaborate. Although interest in collaboration as a skill required by students is increasing, the context of collaboration itself is still unclear. The purpose of this literature observation is to explore conceptualizations, definitions, and understandings in research literature related to collaboration. Collaboration is when in a group there is interaction between members, working together to provide the best role and working together to solve problems or achieve goals. To achieve this goal, there needs to be shared responsibility. The indicators most frequently used are the indicators mentioned by Trilling and Fadel, namely Cooperation, Flexibility, Responsibility, Compromise and Communication. Educators should pay attention to how the design of assessment tasks encourages all students in a group to participate, share thoughts, gather resources and ideas, manage assignments, manage time, and communicate effectively.

Keywords: Collaborative, 21st Century, Cooperation.

Introduction

We are currently in the 21st century which provides fundamental changes in various aspects of life.¹ In this century, everyone is required to have good thinking skills and social attitudes. Likewise in the world of education, education integrates knowledge, skills, attitudes and mastery of technology and information.² Students are required to master skills in this century. In this regard, Voogt and Roblin put forward 12 skills that students need to master in the information age, which are called “21st century skills” or 21st century skills.³ These skills are grouped into three main categories, namely learning skills, literacy skills, and life skills (also called 3L). The category that will be the main focus is the first category, namely learning skills. Educators and students recognize learning skills which consist of 4C, namely critical thinking, creativity, collaboration and communication.⁴

One of the important abilities for students to have and develop is the ability to collaborate. Collaboration has actually long been known in the world of education as a learning approach. Currently, educators have begun to experience a paradigm shift, that collaboration is not only an approach but also an important capability and not just a means for teaching and assessing academics. Although interest in collaboration as a skill required by students is increasing, collaboration itself is still conceptually unclear. Although the literature has revealed many definitions and ways of operationalizing collaboration, the question remains: What is meant by collaborating, and how can collaboration be taught and assessed in schools? The purpose of this

¹ Silfia Ilma et al., “Students Collaboration Skills in Science Learning,” *Proceedings of the 2nd International Conference on Innovation in Education and Pedagogy (ICIEP 2020)* 619, no. Iciep 2020 (2022): 204–8, <https://doi.org/10.2991/assehr.k.211219.037>.

² Elmawati Elmawati and Dadang Juandi, “Mathematical Critical Thinking Ability In Indonesia: Systematic Literature Review (SLR),” *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education* 7, no. 2 (2022): 210–21, <https://doi.org/10.23969/symmetry.v7i2.6426>.

³ Joke Voogt et al., “21 St CENTURY SKILLS DISCUSSION PAPER,” 2010.

⁴ Elmawati and Juandi, “Mathematical Critical Thinking Ability In Indonesia: Systematic Literature Review (SLR)”; ASRI FAUZI et al., “IMPLEMENTASI CASE METHOD (PEMBELAJARAN BERBASIS PEMECAHAN KASUS) DITINJAU DARI” 9, no. 3 (2022): 809–17; Ilma et al., “Students Collaboration Skills in Science Learning”; Rina Dwi Setyawati et al., “Improving Mathematical Critical Thinking Skill through STEM-PjBL: A Systematic Literature Review,” *International Journal on Research in STEM Education* 4, no. 2 (2022): 1–17, <https://doi.org/10.31098/ijrse.v4i2.1141>.

literature review is to explore conceptualizations, definitions, and understandings in the research literature related to collaboration. Important initial questions include: What is collaboration? What indicators are used to measure collaboration? And how to measure collaborative abilities?

The method used is a literature study using descriptive analysis. Data was obtained from research articles that used collaborative capabilities in the period 2010 to 2022 and theoretical references relevant to the cases or problems found. This review journal is based on a number of empirical and conceptual articles on collaborative capabilities. The research results in this article were then analyzed to see collaborative abilities at all levels of education. The data search was carried out using the Scopus Database which was launched using the keywords “collaborative skills”, “collaborative skills” and “collaborative abilities” and 25 documents were found in the initial search

Collaboration, a Conceptual Perspective

Collaboration has many meanings, there is no agreement regarding what collaboration is, although it has been stated that collaboration means providing opportunities for students to work together.⁵ Group work is often a simple division of labor or “free-rider” experience in which students divide tasks and rely on the most competent group members to drive the group product.⁶ In contrast, collaboration actually requires different social and cognitive processes.

Collaboration is seen as a skill expressed by Child and Shaw, Mercer, Zillmer and Kuhn.⁷ Collaboration as a means to improve students’ mastery

⁵ Andrew J. Rotherham and Daniel T Willingham, “Ej889143,” *American Educator* 34, no. 1 (2010): 17–20.

⁶ Gavriel Salomon and Tamar Globerson, “When Teams Do Not Function the Way They Ought To,” *International Journal of Educational Research* 13, no. 1 (1989): 89–99, [https://doi.org/10.1016/0883-0355\(89\)90018-9](https://doi.org/10.1016/0883-0355(89)90018-9).

⁷ Silmon Child and Stuart Shaw, “Collaboration in the 21st Century: Implications for Assessment,,” *A Cambridge Assessment Publication*, no. 22 (2016): 17–22; Gary W. Ladd et al., “Grade-School Children’s Social Collaborative Skills: Links With Partner Preference and Achievement,” *American Educational Research Journal* 51, no. 1 (2014): 152–83, <https://doi.org/10.3102/0002831213507327>; Neil Mercer, “The Quality of Talk in Children’s Collaborative Activity in the Classroom,” *Learning and Instruction* 6, no. 4 (1996): 359–77, [https://doi.org/10.1016/S0959-4752\(96\)00021-7](https://doi.org/10.1016/S0959-4752(96)00021-7); Nicole Zillmer and Deanna Kuhn,

of content knowledge and other important cognitive skills, such as critical thinking and problem solving.⁸ In this view, students work in groups to support more effective learning of academic knowledge and skills. Apart from that, there are also those who interpret collaboration as a process or result of team work expressed by French et.al., Zhuang et.al., Zillmer and Kuhn, and Cleeton.⁹ Therefore, it is important to clarify whether collaboration is seen as a means to an end in which collaboration is the desired outcome (collaboration as an outcome) or, conversely, collaboration is seen as an end in itself (collaboration as a process).

The research literature on collaboration reflects both views, although historically the dominant paradigm has been the first: collaboration as a means to increase students' acquisition of knowledge of important cognitive skills, such as critical thinking and problem solving.¹⁰ In this view, students work in groups to support more effective learning in academic knowledge and skills. Next, the teacher will provide an assessment of whether the intellectual results have been achieved by the individual or group.

Collaboration viewed as an outcome implies that the end product related to the content and productivity of the group takes precedence over the means to achieve the goal.¹¹ Collaboration as an outcome focuses on the quality of the product provided by the student or group to make conclusions about content learning. Therefore, dividing work among group members to

"Do Similar-Ability Peers Regulate One Another in a Collaborative Discourse Activity?," *Cognitive Development* 45, no. July 2017 (2018): 68–76, <https://doi.org/10.1016/j.cogdev.2017.12.002>.

⁸ Deanna Kuhn, "Thinking Together and Alone," *Educational Researcher* 44, no. 1 (2015): 46–53, <https://doi.org/10.3102/0013189X15569530>.

⁹ Brian French et al., "An Investigation of the Psychometric Properties of a Measure of Teamwork among High School Students," *Psychological Test and Assessment Modeling* 58, no. 3 (2016): 455; Xiaohua Zhuang et al., "Development and Validity Evidence Supporting a Teamwork and Collaboration Assessment for High School Students," *ETS Research Report Series* 2008, no. 2 (2008): i–51, <https://doi.org/10.1002/j.2333-8504.2008.tb02136.x>; Zillmer and Kuhn, "Do Similar-Ability Peers Regulate One Another in a Collaborative Discourse Activity?"; Glen U. Cleeton, "Education for Life and Work," in *Making Work Human* (Yellow Springs, OH, US: Antioch Press Publishers, 1949), 144–68, <https://doi.org/10.1037/13246-007>.

¹⁰ Kuhn, "Thinking Together and Alone."

¹¹ Child and Shaw, "Collaboration in the 21st Century: Implications for Assessment."

complete independently is better than relying on the work of high-achieving students (or other undesirable learning practices).¹²

On the other hand, collaboration is also seen as a skill necessary for work and life in society, this is associated with 21st century skills.¹³ Here students work in groups to improve their ability to work together. Therefore, the focus of this learning is the quality of interaction between students. Of course, increased knowledge and academic skills are also a result of collaborative activities, but they are not the focus of collaborative learning. Instead, the focus is on the nature and quality of collaborative activities and interactions among group members/learners. Collaboration as a process focuses on the quality of student interactions.

In several literatures, it is stated that to be able to collaborate, students need knowledge, skills, and cognitive and social dispositions to create high-quality interactions between students.¹⁴ Collaborative brings together people related to social interdependence, communication, negotiation, reflection, and task management. Social interdependence requires certain types of interactions to be promoted within groups.

Johnson and Johnson¹⁵ clarify three ways students can interact with each other, which can be seen in the table below:

Table 1. Types of Interactions Between Students

| Promotive Interaction: Collaborative | Oppositional Interaction: Competitive | No interaction: Individualistic |
|---|---|---|
| Individuals believe that they can achieve their goals only if other individuals are in the same situation | Individuals believe that they can achieve their goals only if other individuals in the situation fail to achieve their goals. | Individuals believe that achieving their goals is not related to what other individuals would do in the same situation. |

From the table above it is known that:

¹² Brigid Barron, "When Smart Groups Fail," *Journal of the Learning Sciences* 12, no. 3 (2003): 307–59, https://doi.org/10.1207/S15327809JLS1203_1.

¹³ Kuhn, "Thinking Together and Alone."

¹⁴ Child and Shaw, "Collaboration in the 21st Century: Implications for Assessment.," Pierre Dillenbourg, "What Do You Mean by ' Collaborative Learning '?" 1, no. March (2014).

¹⁵ Carla Evans, "MEASURING STUDENT SUCCESS SKILLS: A REVIEW OF THE LITERATURE ON COLLABORATION," *Center For Assessment*, 2020, 1–18.

1. Students believe that they are together, because they can achieve their goals only if other students in the group also achieve their goals (promotive interaction: collaborative);
2. Students believe that they can achieve their goals only if other Students in the group fail to achieve their goals (oppositional interactions: competitive); And
3. Students believe that achieving their goals is not related to what other students in the group do (no interaction: individualistic).

The more social interdependence that occurs in a collaborative learning activity or project, the more promotive interactions that occur. Individualistic interactions between students in groups occur more often when learning activities or tasks require a simple division of labor.

Collaboration is different from cooperation when viewed from student interactions.¹⁶ In cooperative learning activities, students will usually divide the work, complete the task individually, and then collect their respective contributions. Therefore, cooperatives do not require collaboration or promotive interactions. This does not mean that division of labor cannot occur in collaborative learning activities; coordination of group thinking and work processes still occurs within collaborative.¹⁷ In contrast to individuals working alone, cooperative learning can produce better group performance results because the division of labor allows more things to be achieved. On the other hand, cooperative learning (or poorly designed collaborative learning activities) can lead to more “free riding” or “social loafing” behavior where individuals do not contribute equally to group goals.¹⁸ This often frustrates students who work in groups.

As mentioned, there are many definitions of collaboration in the research literature. Most are general, but some are specific to collaborative

¹⁶ Dillenbourg, “What Do You Mean by ‘ Collaborative Learning ’?”

¹⁷ Ibid.

¹⁸ Barron, “When Smart Groups Fail”; Salomon and Globerson, “When Teams Do Not Function the Way They Ought To”; David A. Sears and James Michael Reagin, “Individual versus Collaborative Problem Solving: Divergent Outcomes Depending on Task Complexity,” *Instructional Science* 41, no. 6 (November 1, 2013): 1153–72, <https://doi.org/10.1007/s11251-013-9271-8>.

problem solving, as one of the contexts in which collaboration can occur.¹⁹

Below are several definitions of collaboration according to experts.

1. "Collaboration occurs when meeting a goal requires more than what any one individual is able to manage alone and therefore needs to pool resources with others".²⁰
2. "Collaborative problem solving is a joint activity where two or more people work together to contribute resources they alone control, to progress through a series of cognitive states that involve collection and analysis of information and the formulation of a hypothesis that they jointly set out to test".²¹
3. "Collaboration is an individual's capacity to work with other people in a process that requires interdependence to solve a problem, achieve a goal, or complete a task".²²
4. "Collaborative problem solving competency is the capacity of an individual to effectively engage in a process whereby two or more agents attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills, and efforts to reach that solution".²³
5. "Collaboration can be thought of as communication plus additional competencies related to conflict resolution, decision making, problem solving, and negotiation".²⁴
6. "Collaboration is a skill that invites students to actively contribute in working together and interacting during learning so that learning will be easier to understand".²⁵

¹⁹ OECD, "Pisa 2015 Collaborative Problem-Solving Framework," 2017; OECD, "What Students Know and Can Do," *PISA 2009 at a Glance I* (2019), <https://doi.org/10.1787/g222d18af-en>.

²⁰ Esther Care, Claire Scoular, and Patrick Griffin, "Assessment of Collaborative Problem Solving in Education Environments" 7347, no. July (2016), <https://doi.org/10.1080/08957347.2016.1209204>.

²¹ P. Griffin and E. Care, "A Framework for Teachable Collaborative Problem Solving Skills," 2015.

²² Sarah Lench and Ross Crosby Anderson, "Essential Skills and Dispositions: Developmental Frameworks for Collaboration, Creativity, and Self-Direction," *Emotion*, no. October (2015): 1-19.

²³ OECD, "What Students Know and Can Do"; OECD, "Pisa 2015 Collaborative Problem-Solving Framework."

²⁴ Jim Soland, Laura S. Hamilton, and Brian M. Stecher, "Measuring 21st Century Competencies: Guidance for Educators," *Asia Society Global Cities Education Network Report*, no. November (2013): 68.

²⁵ Junita Junita and Krisma Widi Wardani, "Efektivitas Model Pembelajaran STAD Dan CIRC Terhadap Peningkatan Keterampilan Kolaborasi Siswa Kelas V SD Gugus Joko Tingkir Pada Mata Pelajaran Tematik," *JPDI (Jurnal Pendidikan Dasar Indonesia)* 5, no. 1 (2020): 11, <https://doi.org/10.26737/jpdi.v5i1.1688>.

7. "Collaboration skills are the ability to exchange thoughts or ideas and feelings between students at the same level".²⁶
8. "Collaboration is the ability to participate in any activity to build relationships with other people, respect each other's relationships and teamwork to achieve the same goal".²⁷
9. "Collaboration skills are the skills to work together effectively and show respect for diverse teams, practice fluency, and the willingness to make decisions necessary to achieve common goals".²⁸

According to the definitions above, collaboration is when in a group there is interaction between members, working together to provide the best role and working together to solve problems or achieve goals. To achieve this goal, there needs to be shared responsibility. Apart from that, it can also be seen that there are several fundamental aspects that differentiate collaboration from other collaborative activities, namely as follows.

1. Two or more students working together
2. Actively participate in joint activities for example, solving problems, completing tasks, designing products, etc.
3. Unite the knowledge, skills and efforts of all members of the student group.

²⁶ Maharani Lelasari, Punaji Setyosari, and Saida Ulfa, "Pemanfaatan Social Learning Network Dalam Mendukung Keterampilan Kolaborasi Siswa," *Prosiding TEP & PDs*, 2017, 167–72.

²⁷ Hilna Putria, Luthfi Hamdani Maula, and Din Azwar Uswatun, "Analisis Proses Pembelajaran Dalam Jaringan (DARING) Masa Pandemi Covid- 19 Pada Guru Sekolah Dasar," *Jurnal Basicedu* 4, no. 4 (2020), <https://doi.org/10.31004/basicedu.v4i4.460>; K. A. Sari, Z. K. Prasetyo, and S. W. Widodo, "Pengembangan Lembar Kerja Peserta Didik IPA Berbasis Model Project Based Learning Untuk Meningkatkan Keterampilan Kolaborasi Dan Komunikasi Peserta Didik Kelas VII," *Jurnal Pendidikan Matematika Dan Sains*, no. April (2017): 5–24; Monica Feronica Bormasa, "Pengaruh Peran Pemerintah Desa Terhadap Pemberdayaan Masyarakat," *Cerdika: Jurnal Ilmiah Indonesia* 1, no. 3 (March 25, 2021): 255–66, <https://doi.org/10.36418/cerdika.v1i3.48>; Ha Le, Jeroen Janssen, and Theo Wubbels, "Collaborative Learning Practices: Teacher and Student Perceived Obstacles to Effective Student Collaboration," *Cambridge Journal of Education* 48, no. 1 (2018): 103–22, <https://doi.org/10.1080/0305764X.2016.1259389>.

²⁸ Yokhebed Yokhebed, "Profil Kompetensi Abad 21: Komunikasi, Kreativitas, Kolaborasi, Berpikir Kritis Pada Calon Guru Biologi Profile of 21st Century Competency: Communication, Creativity, Collaboration, Critical Thinking at Prospective Biology Teachers," *Bio-Pedagogi* 8, no. 2 (2019): 94, <https://doi.org/10.20961/bio-pedagogi.v8i2.36154>.

Genuine joint activity implies an authentic context and, furthermore, encourages students to pool their knowledge and skills and work interdependently rather than working in parallel and individualistically. The challenge in creating collaborative structures is developing ways to increase opportunities for promotive interactions or collaborative activities.

Dillenbourg²⁹ states that simply placing students into collaborative learning groups will not necessarily produce interactions that are expected to trigger learning mechanisms (e.g., induction, deduction, compilation) or cognitive mechanisms (e.g., knowledge generation, internalization, reduction of cognitive load). To increase the likelihood of collaboration, as defined above, ³⁰ suggests that instruction and assessment focus on four related factors: type of interaction (negotiation, conflict resolution), situational requirements for more/less collaboration (interdependence, interactivity), the impact of collaboration on individual and group products (e.g., improved learning, reasoning, justification, explanation, and final product quality), and the cognitive processes activated (e.g., perspective taking, argumentation, justification, explanation, analysis). These four markers of collaborative learning require the teacher to (a) prepare initial conditions carefully, (b) assign students specific roles or jobs in the group, (c) provide productive interactions by including interaction rules, and (d) monitor and organize interaction.

Furthermore, collaboration is a means to achieve the goal of increasing students' content knowledge so that common academic performance measures can be used. However, when teaching and assessing collaborative processes, we must examine the extent to which the collaborative action or behavior of interest can be observed or reported. These collaboration skills include:

1. Planning and making group decisions

Joint group decisions on how best to manage and complete a task or project, work with the group to assign roles or tasks, use negotiation or conflict resolution skills necessary to plan and make group decisions.

²⁹ Dillenbourg, "What Do You Mean by ' Collaborative Learning '?"

³⁰ Ibid.

2. Communicate thoughts with the group
 Seeking clarity on others’ thinking, respectfully expressing how the thinking makes sense or lacking in some respects, soliciting alternative perspectives and input from all group members, elaborating on others’ explanations.
3. Contribute resources, ideas, and efforts and support group member.
 Contribute ideas, efforts, and resources; supports group members as needed, taking responsibility for assignments and quality of work; provide feedback on the work of others.
4. Monitor, reflect, and adapt individual and group processes to benefit the group
 Reflects on individual and group progress and processes, collaborates with the team to adjust group efforts to achieve goals, adapts individual and/or group processes to benefit the group, asks group members about progress.

Collaboration Skills Indicators

Table 2. Several indicators of collaboration skills

| Indicators | Related Framework |
|---|----------------------------------|
| 1. Interpersonal communication | Pearson P21 |
| 2. Negotiation or conflict resolution | |
| 3. Task management/team regulation. ³¹ | |
| 1. Self-awareness | Essential Skill and Dispositions |
| 2. Communication | |
| 3. Negotiation and Decision Making | |
| 4. Contribute and support | |
| 5. Monitoring and adaptation ³² | |
| 1. Build and maintain shared understanding | PISA |
| 2. Take appropriate action to resolve the problem | |
| 3. Build and maintain a team organization. ³³ | |
| 1. Demonstrate the ability to collaborate effectively and respectfully with diverse teams | P21 |

³¹ Emily R Lai, "Collaboration " A Literature Review," *Pearson*, no. June (2011): 1-49; Em Ily, R Lai, and Michaela Viering, "Assessing 21st Century Skills: Integrating Research Findings National," no. April (2012).

³² Lench and Anderson, "Essential Skills and Dispositions: Developmental Frameworks for Collaboration, Creativity, and Self-Direction."

³³ OECD, "Pisa 2015 Collaborative Problem-Solving Framework."

| | |
|--|-----------------------------------|
| <ol style="list-style-type: none"> 2. Train flexibility and independence to assist in making decisions necessary to achieve common goals 3. Assume shared responsibility for shared work and value the individual contributions made by each team member.³⁴ | |
| <ol style="list-style-type: none"> 1. Task-related process skills (problem solving, decision making, task planning and coordination, strategy formulation, coordination, goal setting, performance management) 2. Cooperation with other people (adaptability and interpersonal skills) 3. Influence team members through support and encouragement (building self-confidence, social support) 4. Resolving conflicts or disagreements between team members through negotiation strategies (conflict resolution and communication) 5. Mentorship with other team members (leadership, and helping other members).³⁵ | ETS Collaborative Problem Solving |
| <p>Collaboration as a process that focuses on the quality of student interactions</p> <p>Social Maintenance</p> <ol style="list-style-type: none"> 1. Social interdependence 2. Communication 3. Cooperation/division of work <p>Socio cognitive</p> <ol style="list-style-type: none"> 1. Share resources 2. Introduction of new ideas 3. Conflict resolution <p>Collaboration as a result of focusing on the quality of participants or output/product groups</p> <p>Cognitive change/learning</p> <ol style="list-style-type: none"> 1. Achieved through a collaborative process 2. Before and after students' knowledge/understanding <p>Product</p> <ol style="list-style-type: none"> 1. Solution to the assigned problem.³⁶ | Cambridge Assessment |

³⁴ Partnership for 21st Century Learning, "Framework for 21st Century Learning," *P21 Partnership for 21st Century Learning*, 2007, 2.

³⁵ Zhuang et al., "Development and Validity Evidence Supporting a Teamwork and Collaboration Assessment for High School Students."

³⁶ Child and Shaw, "Collaboration in the 21st Century: Implications for Assessment."; Simon F.J. Child and Stuart Shaw, "Towards an Operational Framework for Establishing and Assessing

Collaboration and teamwork are ways of working that consist of knowledge, skills, attitudes/values/ethics with four sub-skills: ATC 21S

1. Interact effectively with other people
2. Work effectively in diverse teams
3. Manage projects
4. Guide and lead others to be responsible to others.³⁷

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1. Collaboration
 2. Flexibility
 3. Responsibility
 4. Compromise
 5. Communication.³⁸

The main dimensions of collaboration include: ATC 21S

1. Social interdependence
2. Interpersonal skills
3. Processes related to tasks

Specifically, collaboration includes knowledge, skills, and attitudes, such as:

1. Interact effectively with others and have meaningful conversations;
 2. Knowing when is the right time to listen or speak (social regulation);
 3. Work effectively in diverse teams (conflict resolution and team management)
 4. Introducing new ideas and sharing resources;
 5. Exercise flexibility and a willingness to assist in making the compromises necessary to achieve common goals;
 6. Bearing shared responsibility for teamwork;
 7. Perspective taking
 8. Appreciate the individual contributions made by each team member.³⁹
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Collaborative Interactions," *Research Papers in Education* 34, no. 3 (2019): 276–97, <https://doi.org/10.1080/02671522.2018.1424928>.

³⁷ Patrick Griffin, Barry McGaw, and Esther Care, *Assessment and Teaching of 21st Century Skills, Assessment and Teaching of 21st Century Skills*, vol. 9789400723, 2012, <https://doi.org/10.1007/978-94-007-2324-5>.

³⁸ Bernie Trilling and Charles Fadel, *21st Century Skills- Learning for Life in Our Times, Journal of Sustainable Development Education and Research*, vol. 2, 2009.

³⁹ Care, Scoular, and Griffin, "Assessment of Collaborative Problem Solving in Education Environments."

The indicators most frequently used are the indicators mentioned by Trilling and Fadel namely Cooperation, Flexibility, Responsibility, Compromise and Communication.

Measurement of Collaborative Skill

There are at least five categories of collaborative assessment types: (a) self-report or peer report, (b) global assessment scale, (c) standardized assessment, (d) observational measures, and (e) performance assessment.⁴⁰

Table 3. Types of Collaborative Assessment with Brief Descriptions and Some Benefits/Challenges from a Measurement Perspective

| Assessment Type | Description | Benefits | Challenges |
|------------------------|--|--|--|
| Self- or peer- Reports | Student self- and/or peer-report (survey, questionnaire, assessment or reflection) | 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. ⁴¹ |
| 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 |

⁴⁰ Joshua Cox, Brandon Foster, and David Bamat, "A Review of Instruments for Measuring Social and Emotional Learning Skills among Secondary School Students In Collaboration with the Social and Emotional Learning Research Alliance," no. October (2019); Thomas R. Dye, *Understanding Public Policy*, ed. Stephanie Chaisson, Fourteenth (United State: Pearson Education, 2013); Ily, Lai, and Viering, "Assessing 21st Century Skills: I Ntegrat Ing Research Findings National."

⁴¹ French et al., "An Investigation of the Psychometric Properties of a Measure of Teamwork among High School Students"; Leeann M. Lower, Tarkington J. Newman, and Dawn Anderson-Butcher, "Validity and Reliability of the Teamwork Scale for Youth," *Research on Social Work Practice* 27, no. 6 (October 1, 2017): 716–25, <https://doi.org/10.1177/1049731515589614>; Bram De Wever et al., "Assessing Collaboration in a Wiki: The Reliability of University Students' Peer Assessment," *The Internet and Higher Education* 14, no. 4 (September 1, 2011): 201–6, <https://doi.org/10.1016/j.iheduc.2011.07.003>; Todd R. Kelley et al., "Creating a 21st Century Skills Survey Instrument for High School Students," *American Journal of Educational Research* 7, no. 8 (September 28, 2019): 583–90, <https://doi.org/10.12691/education-7-8-7>.

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|--------------------------|--|--|--|
| | | | teachers. ⁴² |
| 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). ⁴³ |
| 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. ⁴⁴ |
| 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 |

⁴² French et al., "An Investigation of the Psychometric Properties of a Measure of Teamwork among High School Students"; Zhuang et al., "Development and Validity Evidence Supporting a Teamwork and Collaboration Assessment for High School Students."

⁴³ Care, Scoular, and Griffin, "Assessment of Collaborative Problem Solving in Education Environments"; Jiangang Hao et al., "Initial Steps Towards a Standardized Assessment for Collaborative Problem Solving (CPS): Practical Challenges and Strategies," in *Innovative Assessment of Collaboration*, ed. Alina A. von Davier, Mengxiao Zhu, and Patrick C. Kyllonen, Methodology of Educational Measurement and Assessment (Cham: Springer International Publishing, 2017), 135–56, https://doi.org/10.1007/978-3-319-33261-1_9; Alina A. von Davier et al., "Interdisciplinary Research Agenda in Support of Assessment of Collaborative Problem Solving: Lessons Learned from Developing a Collaborative Science Assessment Prototype," *Computers in Human Behavior* 76 (November 1, 2017): 631–40, <https://doi.org/10.1016/j.chb.2017.04.059>; Jiangang Hao et al., "Psychometric Considerations and a General Scoring Strategy for Assessments of Collaborative Problem Solving," *ETS Research Report Series* 2019, no. 1 (2019): 1–17, <https://doi.org/10.1002/ets2.12276>.

⁴⁴ Mercer, "The Quality of Talk in Children's Collaborative Activity in the Classroom"; Merce Garcia-Mila et al., "The Effect of Argumentative Task Goal on the Quality of Argumentative Discourse," *Science Education* 97, no. 4 (2013): 497–523, <https://doi.org/10.1002/sce.21057>; Sylvia Rojas-Drummond and Neil Mercer, "Scaffolding the Development of Effective Collaboration and Learning," *International Journal of Educational Research* 39, no. 1 (January 1, 2003): 99–111, [https://doi.org/10.1016/S0883-0355\(03\)00075-2](https://doi.org/10.1016/S0883-0355(03)00075-2); Carla van Boxtel, Jos van der Linden, and Gellof Kanselaar, "Collaborative Learning Tasks and the Elaboration of Conceptual Knowledge," *Learning and Instruction* 10, no. 4 (August 1, 2000): 311–30, [https://doi.org/10.1016/S0959-4752\(00\)00002-5](https://doi.org/10.1016/S0959-4752(00)00002-5).

student
interactions).⁴⁵

These types of collaborative assessments range from less standardized to more standardized, and the level of standardization is related to the intended use of the assessment information. For example, less standardized types of assessment, such as self-report or peer report, are intended primarily for formative use in the classroom or for research. In contrast, standardized assessments (e.g., situational judgment tests, computer simulations) are intended primarily for large-scale summative assessments.

There are instructional, practical, and technical considerations when selecting (or designing) measures of 21st century competencies.⁴⁶ Instructional considerations relate to the use of assessment information. For example, is the measure intended to be used formatively or summatively? Is it to provide actionable information to teachers, or useful feedback to students? Is the assessment appropriate to level, context, or culture? Practical considerations relate to cost and ease of administration, implementation, and assessment. And technical considerations center on validity, reliability, and fairness. What educators want from the assessment results will influence what instruments will be used.⁴⁷ In developing the test instrument that will be used, the following considerations are usually used.

1. define the targeted construct;
2. create a task to get the desired response;
3. choose the item type;
4. consider various administrative issues;
5. determine the value, code, or score that will be given to the student's response;

⁴⁵ Lynn S. Fuchs et al., "Mathematics Performance Assessment in the Classroom: Effects on Teacher Planning and Student Problem Solving," *American Educational Research Journal* 36, no. 3 (January 1, 1999): 609–46, <https://doi.org/10.3102/00028312036003609>; Marlene Scardamalia et al., "New Assessments and Environments for Knowledge Building," in *Assessment and Teaching of 21st Century Skills*, ed. Patrick Griffin, Barry McGaw, and Esther Care (Dordrecht: Springer Netherlands, 2012), 231–300, https://doi.org/10.1007/978-94-007-2324-5_5.

⁴⁶ Soland, Hamilton, and Stecher, "Measuring 21st Century Competencies: Guidance for Educators."

⁴⁷ Mark Wilson et al., *Perspectives on Methodological Issues, Assessment and Teaching of 21st Century Skills*, vol. 9789400723, 2012, <https://doi.org/10.1007/978-94-007-2324-5>.

6. pilot the assessment, using a large and diverse sample of students;
7. model and analyze responses, taking into account technical issues such as validity, reliability, and fairness of the test.⁴⁸

The development of a valid collaborative assessment is based on the meaning and operationalization of the collaborative construct as well as the purpose and use of assessment information.⁴⁹ In most educational settings, teachers want to assess what each learner knows and can do regarding the collaboration process and the results of collaboration (not just what the group can do). However, collaboration occurs in a group context, which can obscure individual contributions.⁵⁰ Additionally, if the goal is to assess students' sophistication in collaborating, is it necessary to observe students actually collaborating in a group context, or is it sufficient to see whether the students can correctly answer questions about effective collaboration?

If the goal is to measure collaboration as a process, then assessments should be designed to gather evidence of the quality of student interactions, not the quality or quantity of group products.⁵¹ However, if the goal is to measure collaboration as an outcome, then the group process mentioned by Webb⁵² above may actually slow down the group, and the most efficient way to complete a high-quality final product is to have students divide up the work, completing work independently, and relying on high-achieving students to pull the group load. In this way, free riding can actually help groups maximize the quality of the final product, even though it is not considered a best practice for enhancing student learning.⁵³

⁴⁸ Evans, "MEASURING STUDENT SUCCESS SKILLS: A REVIEW OF THE LITERATURE ON COLLABORATION."

⁴⁹ Wilson et al., *Perspectives on Methodological Issues*.

⁵⁰ Lai, "Collaboration " A Literature Review."

⁵¹ Ibid.

⁵² Noreen M. Webb et al., "Equity Issues in Collaborative Group Assessment: Group Composition and Performance," *American Educational Research Journal* 35, no. 4 (1998): 607, <https://doi.org/10.2307/1163461>.

⁵³ Ibid.

Conclusion

Collaboration is an often touted and critical student success skill necessary for work and life in the 21st century. However, the term remains conceptually vague and requires careful definition of the construct, as well as greater clarity of its components, so that educators can teach students essential collaboration skills and provide meaningful, actionable feedback on progress. their collaboration skills over time. Collaboration can be considered as the process or result of joint activity, with the former being usually more in line with how these skills are used in the 21st century skills movement. Collaboration skills are both general and content/context specific because collaborative skills themselves typically do not vary across content areas. However, the content/context in which collaborative activities are situated can have a significant influence on students' ability to transfer their skills.

Assessing 21st century skills such as collaboration is challenging. Educators should pay attention to how the design of assessment tasks encourages all students in a group to participate, share thoughts, gather resources and ideas, manage tasks, organize teams, and communicate effectively. What could potentially conflict with instructional goals is creating collaborative rubrics to grade and grade students. Given the lack of empirical evidence regarding how students should develop competency in collaboration domains at the end of a given time period (end of grade, end of class term, end of 12th grade), we recommend that a continuous collaboration plan be created to delineate student performance from less to more advanced by using shared markers of collaborative processes across the research literature.

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