

Redesigning the Way Teams Work Smarter Using Comprehensive Assessment of Team Member Effectiveness (CATME)

Aisha Mahmood, Muhammad Abbas Choudhary, Aleena Hasan Qurashi
Namal College, Mianwali, Department of Electrical Engineering, Pakistan

Abstract--Teamwork is the top desired professional skill by employers of 21st century, yet it is observed that engineering and computer science graduates lack these skills. One of the reasons is today's traditional teaming approach in the engineering classrooms which is based on either friendship or random grouping schemes. CATME is a research based innovative, online tool for team formation that provides a platform to support smarter teamwork. CATME facilitates the instructor to automatically group students in their most suitable teams based on more than 25 criteria/conditions like soft/hard skills, and other academic and non-academic factors that can be manipulated. This study explores the effects of forming teams using CATME on the overall learning experience, satisfaction and teamwork skills of 75 undergraduate students enrolled in electrical engineering and computer sciences at a private university. This longitudinal study spanning over two semesters entails a mixed methods, quantitative followed by qualitative approach using CATME entry surveys, team evaluation surveys and informal social media conversations. The experience of working in a team, formed by CATME, was peer evaluated to investigate its suitability for interactive learning spaces and help students develop and master team working skills.

I. LITERATURE REVIEW

Inductive teaching and learning methods e.g. project-based learning, collaborative learning, problem-based learning, cooperative learning etc. transform the traditional lecture-based classroom into a social learning experience. Most of them require teams of students with mixed ability to develop an environment of positive interdependence along with individual accountability [1]. In the past, research on teamwork and its effectiveness has been fragmented and the results are limited in their usefulness [2]. Teamwork is not a simple combination of actions by few members, instead it is when all the members join together to form one block, which has its own goal and mission, above the individual goals of the members [3].

Building strong teamwork skills is an integral component of education, specially technical and engineering education. However, formation of teams, based solely on the choice of its members, can inhibit variety and result in an unbalanced team; therefore create hurdles and lead to an undesirable attitude towards the assignment. On the other hand, random or instructor assignment can create scheduling [4] as well as personality conflicts.

CATME stands for "Comprehensive Assessment of Team Member Effectiveness." Although this is only one aspect of the overall system, the acronym has become synonymous for all of the resources provided within the CATME system.

CATME SMARTER teamwork tools offer an informed way to organize and manage group work in large classes. Designed by a multidisciplinary team of academics and consultants, a collection of internet-based tools is made available free of charge, to facilitate instructors in the formation and management of teams/groups. There are two main elements to CATME's offering at the time of this research: (1) Team-Maker and (2) Peer Evaluation.

Team-Maker has two main functions. First, it offers a user friendly, internet-based survey tool for student data collection. The system provides a range of question options including basic demographic data (e.g., gender, race, age, major) as well as items regarding previous course work, schedules, and other background data that might be useful to an instructor in organizing student teams. Instructors can also create their own questions for Team-Maker surveys and share them, if they wish, with other CATME users. Once the data are collected, the instructor can select which information to use as criteria for creating the teams. Further, the system allows you to determine the weighting of each of the criteria to fine tune your team creation priorities. Most of the standard criteria weights in Team-Maker range from -5 to +5, with negative weights resulting in teams with students that reported differing responses to a given question, while those with positive weights produce teams of students with similar responses. After defining the question weights and the maximum or minimum team size, the system will automatically create the teams as specified. Based on instructor's personal experience, it is a good idea to review each of the teams and make sure the algorithm has produced the desired teams. Getting the optimal team compositions can sometimes require adjustment to the criteria or the weightings. Of course, if you choose to let students form their own teams, as the instructor, you are able to import a tab-delimited file containing the names of students', ID numbers, e-mail addresses, and team identifiers directly into CATME. Regardless of your preferred approach, once you are satisfied with the teams in the system, you can release the results to your students, who will be able to see a summary with their team members' names and e-mail addresses. For more details on how the algorithm works, the support documentation available on the CATME website (go to www.catme.org and then click on the "find out more" link) provides a useful explanation, or you can refer to a related research article for even more detailed information [5].

Secondly, CATME system provides the facility of peer evaluation. Although discussions have not yet reached a

conclusive agreement on a distinct teamwork or team effectiveness model, significant study of existing literature has been done by CATME team in designing a usable and reliable measurement scale for self and peer rated team performance. The student behaviors are classified based on the following five criteria: “Interacting with Teammates,” “Contributing to the Team's Work,” “Expecting Quality,” “Keeping the Team on Track,” and “Having Relevant Knowledge, Skills, and Abilities.” Students rated their team members and themselves on a single screen, making comparisons of peer evaluations easy and obvious. Moreover, the instructor has the authority to further deepen the evaluation by including supplementary scale options provided by the CATME online tools, that were selected from the team literatures to measure team disagreements, contentment, consistency, cohesion and other processes [6]–[11].

The following behaviors are a cause for concern [12]:

- Low Performer—a student who gets rated “ineffective” by himself and his teammates alike.
- Overconfident—a student who rates himself significantly more effective whereas gets rated “ineffective” by other teammates.
- High Performer—a student who rates himself as well as gets rated “highly effective” by his teammates.
- Underconfident—a student who rates himself as ineffective but gets highly rated by teammates.
- Manipulator—a student who rates himself as “exceedingly effective” but his teammates ineffective.
- Personality Conflict—“a team with extensive disparity among the raters about the effectiveness of an individual.”
- Clique—a team that “appears to have formed subgroups within the group, and rate members of their subgroup high whereas members of the other subgroups low.”

Although designed in the United States, the CATME team tools are also used in the following countries: Costa Rica, Pakistan, Chile, Qatar, Spain, Ecuador, Hong Kong, the United Kingdom, Australia, Egypt, Bangladesh, India, Germany, Brazil, Turkey, Saudi Arabia, Denmark, Thailand, China, Colombia, Cyprus, Russia, Finland, Indonesia, France, Malaysia, Japan, Ireland, Lebanon, Bahrain, the Netherlands, Canada, New Zealand, Norway, Philippines, the United Arab Emirates, Portugal, Romania, Kuwait, Singapore, Vietnam, South Africa, Mongolia, South Korea, Switzerland, the United Kingdom, and Mexico [13].

II. RESEARCH DESIGN & METHODOLOGY

A mixed method (qualitative embedded in quantitative) [14] research design [15], [16] methodology was employed in this study. CATME Team-Maker was used to collect demographical data about the participants. Based on this information, they were divided into 20 groups, each comprising of maximum four members. Throughout the semester, various activities and tasks were assigned to the groups. These tasks required the individuals to collaborate by brainstorming ideas, selecting an action plan, dividing duties and actual implementation outside the classroom timings. The final project i.e. to develop a prototype of a computer-based systems replacing a paper-based system, was completed in their respective teams and ended with the demonstration of their prototypes. The team work was evaluated by regularity/frequency/usefulness of the record of meetings and/or progress reports to tutor/group meeting agreed deadlines, planning/organization e.g. schedule, division of jobs, group website or other means of communication/document version control/collaboration: usefulness, accessibility, frequency of update. At the end of the semester, feedback and data was collected from the participants in the form of CATME peer evaluations and secret message to the instructor. This data was analyzed to investigate the effectiveness of team work assisted by CATME.

A. Research Question

This research aimed to explore the effects of using CATME on team formation, teamwork and team evaluation. CATME takes into account 25 factors and divides a sample into groups based on these factors. Therefore, it is probable that the resulting teams would be more effective than teams formed randomly or based on friendships. The research question addressed by this study is: How CATME Team Tools supports smart team work?

B. Participants

The sample size for this study was (n=75). The participants were undergraduate students enrolled in a private college in the fields of electrical engineering and computer sciences. The participants were a mixture of campus residents and day scholars. All participants joined their respective fields of study after completing their F.Sc. i.e. the Intermediate Examination required to enter in a bachelors program in Pakistan.

Fig. 1 shows a snapshot of the entry survey data collected from the participants. Instead of using actual names, their student identification numbers were used for the purposes of anonymity with the consent of students.

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Student ID	Sex	GPA	Schedule	Pct Busy	Weekends	Commute	On-Campus Job	Off-Campus Job	Age
14031258	Male	2.0 (1)	3 days/week with 2+ hr meeting blocks (schedule summary)	12%	Prefer	Longer	30 (2)	2 (1)	20 (2)
14031201	Male	2.8 (1)		52%	Prefer	30min	45 (3)	22 (3)	19 (1)
14031274	Male	4 (4)		63%	Prefer	30min	30 (2)	15 (2)	20 (2)
14031205	Male	3 (2)		47%	OK	30min	08 (2)	00 (1)	22 (4)
		0.00	1.00		0.00	0.00	0.00	0.00	0.00
14031257	Male	3 (2)	4 days/week with 2+ hr meeting blocks (schedule summary)	69%	Avoid	Longer	32 (3)	10 (1)	18 (1)
14031200	Male	4 (4)		25%	Avoid	30min	55 (5)	5 (1)	21 (4)
14031252	Male	3.00 (2)		28%	No	Longer	4 (2)	5 (1)	20 (2)
14031259	Male	3.1 (3)		42%	Avoid	Longer	10 (2)	7 (1)	20 (2)
		0.00	3.00		0.00	0.00	0.00	0.00	0.00
14031224	Male	2.7 (1)	0 days/week with 2+ hr meeting blocks (schedule summary)	53%	OK	Longer	12 (2)	3 (1)	20 (2)
14031221	Male	3 (2)		84%	OK	Longer	0 (1)	0 (1)	20 (2)
14031186	Male	2.5 (1)		100%	Prefer	Longer	30 (2)	80 (4)	20 (2)
14031195									
		0.00	-5.00		-1.67	0.00	0.00	0.00	0.00
14031244	Male	2.9 (2)	2 days/week with 2+ hr meeting blocks (schedule summary)	71%	OK	On-Campus	60 (5)	3 (1)	22 (4)
14031249	Male	3 (2)		75%	OK	Longer	30 (2)	30 (3)	19 (1)
14031206	Female	3.5 (4)		43%	OK	30min	43 (3)	20 (2)	19 (1)
14031207	Male	3.7 (4)		45%	OK	30min	0 (1)	0 (1)	19 (1)
		5.00	0.00		5.00	0.00	0.00	0.00	0.00
14031211	Male	2.6 (1)	1 days/week with 2+ hr meeting blocks (schedule summary)	56%	No	30min	55 (5)	10 (1)	19 (1)
14031254	Male	2.6 (1)		59%	Prefer	30min	65 (5)	40 (3)	19 (1)
14031251	Male	3.1 (3)		71%	No	Longer	45 (3)	3 (1)	20 (2)
14031213	Male	3.75 (4)		60%	OK	30min	0 (1)	0 (1)	19 (1)
		0.00	2.50		-2.50	0.00	0.00	0.00	0.00

Fig. 1: Snapshot of the entry survey data

C. Data Collection

At the start of the semester the entry survey was recorded and at the end of the semester, systematic peer ratings, self-assessments by individuals and teams were collected from all the students using the Peer Evaluation tool, CATME. Furthermore, informal conversations were frequently carried out throughout the data collection and analysis phases of the study. The qualitative data was collected not only to support the quantitative data but to triangulate the results and validate the procedure by seeking support between the two sources of information.

The following multiple ways were used to gather the information from 75 students

1. Students' online entry survey (using CATME)
2. Team evaluation (using CATME)

3. Confidential comments of students to instructor (using CATME)
4. Informal conversations to resolve team conflicts
5. Follow-up survey to explore initial finding (using CATME)

III. DATA ANALYSIS AND DISCUSSION

The number of students' behaviors falling under the labels "Under Confident (Under)", "Overconfident (Over)", "Low Performer (Low)", "High Performer (High)", "Personality Conflict (Conflict)", and "Clique Behavior (Clique)" are shown in Table 2 on the basis of summary report of peer evaluation as shown in Table 1.

TABLE 1: SUMMARY REPORT

Team ID	Contrib. to Team	Interact w/ Team	Keeping on Track	Expect Quality	Having KSAs	Adj Factor (w/ Self)	Adj Factor (w/o Self)	Note
CS-02	3.2	3	2.5	2.8	2.8	0.88	0.93	Cliq
CS-02	3.2	2.5	3.5	2.5	3	0.91	0.87	Cliq
CS-02	3.8	2.8	4	3.2	3.8	1.08	1.14	Cliq
CS-02	3.8	3.8	3.8	2.8	4.2	1.13	1.12	Cliq
CS-03	4	4	3.5	3.5	3	0.94	0.97	
CS-03	4.2	3.8	4	4	3.8	1.03	1.05	
CS-03	4.5	4.2	4	3.8	3.2	1.03	1.02	
CS-03	4.5	4	4	3.5	3.5	1.01	1.08	Under
CS-04	3.5	4.2	3.5	4.5	4.2	0.99	0.96	
CS-04	3.8	4.2	3.8	4.2	4.5	1.02	1.04	
CS-04	4	4.5	5	5	5	1.16	1.16	High
CS-04	3.2	3.5	3.2	3.2	3.5	0.83	0.8	
CS-05	4.3	4.7	4.7	4.3	4.7	1.11	1.12	
CS-05	3.7	3.7	3.3	3.7	4	0.9	0.84	
CS-05	3.7	4.3	4.3	4	3.7	0.98	0.91	

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TABLE 1 (CONTINUED)

Team ID	Contrib. to Team	Interact w/ Team	Keeping on Track	Expect Quality	Having KSAs	Adj Factor (w/ Self)	Adj Factor (w/o Self)	Note
CS-06	4.8	4.5	3.5	3.8	4	1.1	1.12	
CS-06	4.2	4	4	3.5	4.5	1.08	1.09	
CS-06	3.8	4	4.2	3.5	3.2	1	0.99	
CS-06	2.2	3.5	3.5	3.2	2.8	0.82	0.7	Over
CS-07	4	3.8	3.8	3.8	2.8	0.91	0.85	Cliq
CS-07	4.5	4.5	4.2	4.5	4.2	1.11	1.11	Cliq
CS-07	4	4	3.8	3.8	4.8	1.03	0.98	Cliq
CS-07	3.5	4	3.5	3.8	4	0.95	0.87	Cliq
CS-08	3.2	4.5	3.8	3.8	3.2	0.89	0.88	
CS-08	3.8	4.8	4.2	4.2	3.8	1	0.95	
CS-08	4.8	4.2	4.2	4.8	4.8	1.1	1.14	High
CS-08	4.2	4.2	4	4	4.2	1	1	
CS-09	3.8	4.2	4.5	4.2	3.8	1.04	1.05	
CS-09	4	4.8	4.2	4	4	1.07	1.1	
CS-09	3.5	4	3.8	3.8	4.5	0.99	0.97	
CS-09	3.8	2.8	4	4	3	0.89	0.82	
CS-10	4	4	4	4.3	4	0.93	0.84	
CS-10	4.7	4.3	4.7	5	4.7	1.07	1.05	
CS-10	4.3	4.7	4.7	4.3	4	1.01	0.99	
CS-11	4	3	3.2	4.2	3.8	0.99	0.95	Cliq
CS-11	3.5	4.5	3	3.5	3	0.95	0.89	Cliq
CS-11	4.2	4	3.8	4	4.2	1.1	1.11	Cliq
CS-11	3.5	2.5	4.5	4.5	2.8	0.96	0.93	Cliq
CS-12	3.3	3.7	4.3	3.7	3.7	0.98	0.97	
CS-12	4.3	4	3	4	4	1.01	0.98	
CS-12	4.3	3.7	4.3	3.3	3.7	1.01	0.92	
CS-13	4.5	4.2	4.5	4.5	4.5	1.25	1.25	High
CS-13	3.5	3.8	3.2	3.8	3.5	1	0.88	
CS-13	3.2	3.8	3.5	3.8	4.5	1.05	1.01	Conf
CS-13	2.5	2.8	2.2	2.5	2.5	0.7	0.63	
CS-14	4.3	5	4.7	4	3.7	1.01	1.02	
CS-14	4.7	3	4	4	4	0.92	0.95	
CS-14	4.3	4.3	4.7	4.7	5	1.07	1.08	
CS-15	4.2	5	3.5	4	4.2	1.04	1.01	
CS-15	3.2	4.2	4	3.5	4.5	0.97	1.01	
CS-15	4	4	3.8	4.2	4.5	1.02	1.03	
CS-15	3.2	3.8	3.8	4	4.8	0.97	0.96	
CS-16	4	4.5	4	3.8	3.8	0.89	0.94	Under
CS-16	4.5	4.8	4.2	4.8	4.5	1.02	1.07	Under
CS-16	5	5	4.5	5	5	1.09	1.1	
CS-16	4.5	5	3.5	4.2	5	0.99	1	
EE-1	4.3	4.3	4	4	4.3	1.01	0.99	
EE-1	4.3	4.3	4	4	3.7	0.97	0.96	
EE-1	4.3	4	4.3	4.3	4.3	1.02	1.05	
EE-2	3.8	3	2.8	4	3.2	1.09	1.09	Conf
EE-2	5	4.2	3.5	3.2	3	1.23	1.28	High
EE-2	2.2	2.5	2.8	1.8	3	0.79	0.81	
EE-2	2.8	2.8	3.2	2.5	2.5	0.89	0.83	
EE-3	3.2	2.8	4.5	4.5	3.2	1	0.99	Cliq
EE-3	3.8	3.5	3.2	4.2	3.8	1.02	0.97	Cliq
EE-3	4.2	3.8	3.5	3.5	3.5	1.02	0.98	Cliq
EE-3	3.2	3.8	4	3.2	3.2	0.96	0.91	Cliq
EE-4	3.2	3.8	4.2	3.5	4	1.08	1.15	Under
EE-4	3.8	4.5	4.2	4	3.5	1.16	1.14	
EE-4	2.8	4	3.5	4.5	4	1.08	1.05	
EE-4	3	2.2	1.8	2.5	2.2	0.68	0.56	Over
EE-5	4	4	3.5	4	4.2	1.1	1.1	High
EE-5	4.2	3.8	3.2	3.8	4	1.06	1.04	Conf
EE-5	4.2	4	4.2	2.8	3.5	1.04	1.07	
EE-5	3.8	2.8	2.2	3.2	2.5	0.81	0.64	Over

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TABLE 2: BEHAVIORS AS A RESULT OF CATME PEER EVALUATION

Manipulator	Under-Confident	Over-Confident	Low-Performer	High-Performer	Personality Conflict	Cliques Behavior	Normal	Total
0	4	3	0	5	5	16	42	75

Sixteen out of twenty groups had a good teamwork experience without any major conflicts or issues. Out of the 20 groups, only 4 resulted in “Cliques” behavior i.e. had extensive disparity in ratings among team members. The confidential comments didn’t help the instructors to figure out the reasons for their “Cliques” behaviors so follow up questions and informal conversations helped them to resolve the issues among these teams. As a result of individual accountability, low performers and manipulators were discouraged, thus not found a single case among 75 students. Three students were over confident whereas four were under-confident and were advised accordingly. Five students were turned to be high performers, thus treated with appreciation whereas five were having personality conflict and advised to be effective team members. Automated feedback is sent to every student by releasing the results and suggestions for future team work. Along with the feedback “how you rated yourself,” how your teammates rated you” and “average rating for you and your team” for every area of teamwork, all

the students were suggested based on the research “how to improve rating in the respective area.” Table 3 shows different research based suggestions in respective areas of teamwork.

The feedback suggestions served the purposes of self-evaluation, reflection, identification of strengths and weaknesses, and positives and negatives of the individual as a team player and of other team members.

The major themes that emerged from the comments is that majority of the students enjoyed the team work activities and in fact want more opportunities to work in a group to further enhance their skills. Majority students expressed appreciation for their team members and felt that there was good cohesion and understanding between members. Only 1 out of 75 students felt that there were scheduling conflicts among the team due to their different time tables; and only 6 requested a change in teams for the last project. The comments from the students of both these groups identify the need for more group activities in order to develop teamwork skills.

TABLE 3: RESEARCH BASED SUGGESTIONS IN RESPECTIVE AREAS OF TEAMWORK [12]

Teamwork Area	Research-based Suggestions to improve the ratings in this area
Contributing to the Team's Work	<ul style="list-style-type: none"> ✓ Fulfill your responsibilities to the team. ✓ Come to team meetings prepared. ✓ Keep trying when faced with difficult situations. ✓ Do a fair share of the team's work. ✓ Make important contributions to the team's final product. ✓ Complete your work in a timely manner. ✓ Do work that is complete and accurate. ✓ Offer to help teammates when it is appropriate.
Interacting with Teammates	<ul style="list-style-type: none"> ✓ Communicate effectively. ✓ Let other team members help when it is necessary. ✓ Get team input on important matters before going ahead. ✓ Exchange information with teammates in a timely manner. ✓ Provide encouragement to other team members. ✓ Facilitate effective communication in the team. ✓ Hear what teammates have to say about issues that affect the team. ✓ Use teammates' feedback to improve performance. ✓ Express enthusiasm about working as a team. ✓ Accept feedback about strengths and weaknesses from teammates.
Keeping the Team on Track	<ul style="list-style-type: none"> ✓ Stay aware of fellow team members' progress. ✓ Provide constructive feedback to others on the team. ✓ Help the team to plan and organize its work. ✓ Motivate others on the team to do their best. ✓ Stay aware of external factors that influence team performance. ✓ Assess whether the team is making progress as expected. ✓ Make sure that everyone on the team understands important information.
Expecting Quality	<ul style="list-style-type: none"> ✓ Expect the team to succeed. ✓ Care that the team produces high-quality work. ✓ Believe that the team should achieve high standards. ✓ Believe that the team can produce high-quality work.
Having Related Knowledge, Skills, and Abilities	<ul style="list-style-type: none"> ✓ Have the skills and expertise to do excellent work. ✓ Have enough knowledge of teammates' jobs to be able to fill in if necessary. ✓ Have skills and abilities that other team members lacked. ✓ Be willing to develop new expertise to benefit the team.

Moreover, one member pointed out a disparity in the level of cognitive abilities and maturity of the team members which resulted in an unsatisfactory teamwork experience.

IV. CONCLUSIONS

Smarter team work using CATME is evidenced with 75 undergraduate students from electrical engineering and computer sciences disciplines at a private college. Use of CATME smarter teamwork tools in the creation of teams has not only increased the effectiveness of teamwork but also led to higher individual and self-accountability. However, the present level of CATME tool requires instructor's supervision and active involvement for resolving conflict and re-assigning teams if required.

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REFERENCES

- [1] M. J. Prince and R. M. Felder, "Inductive Teaching and Learning Methods: Definitions, Comparisons, and Research Bases," *J. Eng. Educ.*, vol. 95, no. 2, pp. 123–138, 2006.
- [2] E. Salas, D. Sims, and C. Burke, "Is there a 'Big Five' in teamwork?," *Small Gr. Res.*, vol. 36, no. 5, pp. 555–599, 2005.
- [3] P. R. Cohen and H. J. Levesque, "Teamwork," *JSTOR Spec. Issue Cogn. Sci. Artif. Intell.*, vol. 25, no. 4, pp. 487–512, 1991.
- [4] C. S. Simmons, "Using CATME Team-Maker to Form Student Groups in a Large Introductory Course," 2015.
- [5] R. A. Layton, M. L. Loughry, M. W. Ohland, and G. D. Ricco, "Design and validation of a web-based system for assigning members to teams using instructor-specified criteria," *Adv. Eng. Educ.*, vol. 2, no. 1, pp. 1–38, 2010.
- [6] S. A. Carless and C. De Paola, "The measurement of cohesion in work teams," *Small Gr. Res.*, vol. 31, no. 1, pp. 71–88, 2000.
- [7] A. Edmondson, "Psychological safety and learning behavior in work teams," *Adm. Sci. Q.*, vol. 44, no. 2, pp. 350–383, 1999.
- [8] K. A. Jehn and E. A. Mannix, "The dynamic nature of conflict: A longitudinal study of intragroup conflict and group performance," *Acad. Manag. J.*, vol. 44, no. 2, pp. 238–251, 2001.
- [9] M. L. Loughry and H. L. Tosi, "Performance implications of peer monitoring," *Organ. Sci.*, vol. 19, no. 6, pp. 876–890, 2008.
- [10] M. W. Ohland, L. G. Bullard, R. M. Felder, C. J. Finelli, R. A. Layton, M. L. Loughry, H. R. Pomeranz, D. G. Schumucker, and D. J. Woehr, "The Comprehensive Assessment of Team Member Effectiveness: Development of a Behaviorally Anchored Rating Scale for Self- and Peer Evaluation," *Acad. Manag. Learn. Educ.*, vol. 11, no. 4, pp. 609–630, 2012.
- [11] G. S. VEGT, B. J. M. Emans, and E. VLIERT, "Patterns of interdependence in work teams: A two-level investigation of the relations with job and team satisfaction," *Pers. Psychol.*, vol. 54, no. 1, pp. 51–69, 2001.
- [12] M. Ohland, M. Loughry, and R. Carter, "Comprehensive Assessment of Team Member Effectiveness. CATME, A New Peer Evaluation Instrument," 2006. [Online]. Available: www.catme.org.
- [13] M. W. Ohland, R. A. Layton, D. M. Ferguson, M. L. Loughry, and H. R. Pomeranz, "SMARTER teamwork: system for management, assessment, research, training, education, and remediation for teamwork," in *118th American Society of Engineering Education Annual Conference*, 2014.
- [14] J. W. Creswell, *Educational Research Planning, Conducting and Evaluating Quantitative and Qualitative Research*, Fourth. Pearson Education, Inc., 2012.
- [15] J. W. Creswell and V. L. P. Clark, "Designing and conducting mixed methods research," 2011.
- [16] J. W. Creswell, *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*, Third. California, New Delhi, London: Sage Publications, Inc., 2009.