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Teaching of transferable teamwork competencies in higher education: development of the TWC Training Protocol©

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Teamwork competencies are essential for career success, yet higher education often lacks structured, effective training for developing those. This paper introduces the Teamwork Competency (TWC) Training Protocol©, a structured framework grounded in action research principles, designed to enhance students' teamwork competencies through iterative cycles of planning, action, reflection, and adjustment. It integrates theoretical foundations of teamwork with experiential learning, incorporating team charters, self- and peer assessments, and guided team reflections. Theoretical foundations and protocol development are described, followed by a pilot study across disciplines in Malaysia and the United States. Results suggest that the protocol advances key student teamwork competencies, such as open communication, planning and coordinating, goal setting, collaborative problem-solving, performance monitoring, as well as building trust and team cohesion. It also mitigates common challenges of social loafing and interpersonal conflict. Thus, the introduced protocol provides a scalable, evidence-based approach to teaching teamwork in higher education.

KEYWORDS

teamwork training, teamwork competencies, action research, reflection, higher education

1 Background and rationale

It is widely recognized that effective teamwork leads to better results in the workplace and the classroom (Arora et al., 2023; Franken et al., 2024; Moxie et al., 2025). Accordingly, preparing students for collaborative work is an important task for college educators. *Teamwork* refers to the collaborative process of a group of individuals working together to achieve a common goal or complete a shared task, typically by coordinating skills, responsibilities, and communication (Campbell et al., 2024). Effective teamwork requires certain *teamwork competencies*, which represent an integration of knowledge, skills, attitudes, and cognitive processes required to work effectively in teams over time (Cannon-Bowers and Salas, 2014). Thus, teamwork competencies encompass teamwork skills (e.g., coordination, planning, problem-solving, communication, emotional intelligence, and conflict resolution) and also involve deeper metacognitive and motivational elements that foster sustained team effectiveness.

Although teamwork competencies are essential for employability and career success in the 21st century (Indeed Editorial Team, 2024), most college students receive little direct and structured training in this domain. Previous research indicated that academic teams often lack sufficient planning, fail to adequately monitor team progress, rely heavily on a strategy commonly known as divide-and-conquer, and frequently experience persistent interpersonal

conflict (Campbell et al., 2024; Chang and Brickman, 2018; Deeter-Schmelz et al., 2002; Wilson et al., 2017). As a result, many students not only fail to acquire effective teamwork competencies but also often develop negative attitudes toward collaboration, which may hinder their future careers.

In this paper, we introduce the *Teamwork Competency (TWC) Training Protocol*®, a structured approach to developing students' teamwork competencies in higher education. The TWC protocol draws on the principles of an action research paradigm and Marks et al.'s (2001) taxonomy of effective team processes – transition, action, and interpersonal processes – to target key competencies associated with each category. Below, we review theoretical frameworks of teamwork and existing teamwork training approaches and then describe the development process of the TWC Training Protocol®.

2 Theoretical foundation

2.1 Developing teamwork competencies in alignment with teamwork processes

Preparing students for effective teamwork in professional settings requires moving beyond unstructured collaboration and adopting evidence-based frameworks that define, support, and assess teamwork competencies. The most widely recognized framework for describing teamwork was proposed by Marks et al. (2001), who argued that effective industry teamwork involves transition processes, action processes, and interpersonal dimensions. *Transition processes* encompass mission analysis, goal clarification, strategic planning for the project, and necessary adjustments. *Action processes* focus on monitoring progress toward completion, which includes tracking work progress, managing resources, information, and equipment, and addressing individual team members' performance needs. Monitoring also ensures that the sequencing and timing of activities are coordinated for optimal performance. Finally, effective *interpersonal processes* address both team and individual needs by fostering motivation, confidence, and emotional well-being, as well as managing conflict effectively.

Based on Marks et al.'s (2001) model, training of teamwork competencies should align with the corresponding teamwork processes. For example, for transition processes, students should be trained to engage in strategic planning, set goals, and assign tasks according to team members' strengths and weaknesses. To develop action processes, students should learn to monitor their progress toward goals, manage resources and information, coordinate sequencing and timing of individual tasks, and adequately address any performance issues. Finally, to strengthen interpersonal processes, students should develop competencies in synchronizing team activities, building trust and cohesion, engaging in back-up behaviors, providing emotional support to their team members, and effectively managing conflict.

2.2 Active research in developing teamwork competencies

Previous research suggested that the best way to advance teamwork competencies is through an *action research* paradigm that

implements iterative cycles of planning, action, observation, reflection, and adjustment (Kemmis and McTaggart, 1988; Kemmis and McTaggart, 2000; King et al., 2008; Mathieu et al., 2008; Scott-Ladd and Chan, 2008). Rather than treating teamwork as a one-time activity, students should engage in a structured, spiraling process where each team project becomes an opportunity to critically assess performance, identify challenges, and develop targeted action plans for improvement (Campbell et al., 2023). This iterative structure enables students to internalize key teamwork processes – such as mission analysis, strategic planning, resource coordination, communication, and conflict management – by repeatedly applying them, reflecting on their effectiveness, and refining their practices (Marks et al., 2001). Over time, students not only enhance their task-based teamwork skills but also foster emergent team qualities like cohesion, mutual respect, and constructive conflict management, ultimately preparing them for the collaborative demands of professional environments (Black et al., 2018; Fung, 2014; Paul et al., 2016).

Despite the insights offered by the above-mentioned models, many instructors expose students to only a limited understanding of teamwork by forming small groups and assigning semi-structured team projects for students to complete over the term. For example, a student team might be tasked with completing a literature review, designing a research project, or investigating and solving a problem. Teams are often expected to determine how they will accomplish the assigned work and how roles will be distributed among members. While these tasks are sometimes scaffolded, they often are not. Students are rarely introduced to the process of reflecting on their outcomes and planning next steps to adjust their teamwork processes. To adequately prepare students for effective teamwork, educators must adopt a more structured approach that intentionally aligns with established teamwork models and incorporates an iterative process.

3 Existing approaches to training teamwork competencies

Existing pedagogical approaches to training teamwork competencies can be classified into three major categories: (1) specialist education approaches from highly collaborative professions (e.g., nursing, engineering); (2) management approaches exploring leadership and followership; and (3) general pedagogical approaches including the action research paradigm, problem-based learning (PBL), and team-based learning (TBL).

3.1 Specialist education approaches

Specialist education programs, such as *The Team Strategies and Tools to Enhance Performance and Patient Safety* (TeamSTEPPS; King et al., 2008), aim to improve team performance in healthcare settings by following a structured process in which teams assess the project context, plan activities, implement them, evaluate their effectiveness, and work toward sustaining improvements. Although the TeamSTEPPS program's specialization in a particular discipline (i.e., nursing) enhances training effectiveness within this profession, it makes transferring the program to other fields difficult, requiring

extensive modifications to the teamwork competencies component and hindering broader applicability across diverse educational contexts.

For business education, a practical, evidence-based model for teaching effective teamwork was proposed by Hillier and Dunn-Jensen (2013). Drawing on organizational learning and group feedback theory (Garvin et al., 2008; London and Sessa, 2006), they proposed a structured learning team model that emphasizes team-level (rather than individual) feedback to improve team performance. The model is based on three key components: (1) Team Charter that sets early expectations and ground rules; (2) Team Effectiveness Feedback Form that is completed after each major assignment; and (3) Formal Team Assessment that has to be completed mid-semester. When used consistently, these tools would help teams collaboratively establish and reinforce productive norms, diagnose problems, and make necessary course corrections. The approach shifts away from individual peer evaluations, which can breed conflict or avoidance, toward promoting collaborative reflective activity that would enable real-time learning and team development. This approach was shown to improve teamwork effectiveness as well as student engagement and overall satisfaction with their teamwork (Hillier and Dunn-Jensen, 2013). The limitations of this approach are feedback inflation and logistical challenges.

Overall, specialist educational practices either embed disciplinary perspectives that make generalization hard or they take those perspectives for granted and do not introduce theoretical frameworks critical for students to make sense of and communicate their experiences.

3.2 Management approaches

Researchers studying workforce teams often use the *input-process-outcome (IPO) model* (Mathieu et al., 2008), in which inputs represent team characteristics and conditions affecting work, processes refer to team activities, and outcomes include team satisfaction and final products. Similarly, the *input-mediator-output-input (IMOI) loop* (Grossman et al., 2017) emphasizes the use of past experiences as inputs, thus positively affecting the subsequent processes by fostering a continuous cycle of learning and improvement. The *Agile philosophy (Manifesto for Agile Software Development, 2001)* conceptualizes teamwork as an empirical process, advocating for teams to experiment with their processes and learn from both failures and successes. In this approach, the instructor serves as a guide, supporting students in their teamwork learning process. *Scrum*, a widely used Agile framework, employs short, time-boxed iterative work cycles known as sprints. Each sprint produces a version of the product that can be refined in subsequent cycles, thus promoting flexibility in teamwork and adaptability to evolving project requirements (Schwaber and Sutherland, 2020).

An important concern with this literature as a resource for teaching teamwork competencies is that it assumes team members already possess basic teamwork knowledge and skills. When fundamental teamwork competencies are already in place, these techniques serve as powerful tools for refining team practices and fostering high-performing teams. However, if team members have not yet mastered these foundational competencies or lack the conceptual framework needed to engage in effective team discussions, such techniques may result in confusion, dissatisfaction, and

disengagement. This, in turn, can exacerbate the challenges commonly observed in current college-level teamwork training.

3.3 General pedagogical approaches

One widely used general pedagogical approach is the *action research paradigm* (Kemmis and McTaggart, 2000; Kuit et al., 2001; Scott-Ladd and Chan, 2008), which involves iterative cycles of teamwork, action, observation, and reflection, leading to planned improvements that inform subsequent cycles. Originally developed for the medical field, particularly in critical care teams where team dysfunction could have serious consequences, it has also been applied in military and other organizational settings where teams must function optimally to achieve their goals.

Another influential method is *problem-based learning (PBL)* – a collaborative approach in which students actively engage with, define, and solve a significant problem to facilitate their learning (Sherwood, 2004; Yew and Goh, 2016). Rooted in social constructivism, PBL encourages students to work through problems with instructor guidance, collaborate with peers, learn from each other, and reflect on their learning. A third approach, *team-based learning (TBL)*, structures the entire course around teamwork, promoting deep engagement and accountability (Michaelsen et al., 2004). In this approach, teams engage in collaborative activities during every class throughout the semester, applying their knowledge to solve problems and complete tasks. Individual and team assessments reinforce the importance of teamwork, whereas class discussions and exercises deepen students' understanding of course content.

Furthermore, enhancement of teamwork competencies through regular, structured assessments has been proposed in the web-based system called the Comprehensive Assessment of Team Member Effectiveness (CATME; Loughry et al., 2014; Ohland et al., 2012; <http://www.catme.org/>). The system incorporates three main tools: (1) Team-Maker; (2) CATME Peer Evaluation; and (3) Rater Calibration. Team-Maker automatically forms diverse and balanced teams using instructor-defined criteria, such as gender, race, or expertise, providing a serious advantage in larger classes. CATME Peer Evaluation collects self-and peer assessments based on five evidence-based dimensions of effective teamwork: interacting with teammates, contributing to the team, keeping the team on track, expecting quality, and demonstrating relevant skills and knowledge (Loughry et al., 2007, 2014). The system also provides actionable analytics, such as individual and team averages, self-other rating discrepancies, and grade adjustment factors to help instructors evaluate students' performance and identify underperforming or overconfident students, as well as interpersonal conflicts (Braender and Naples, 2013). Despite its strengths, CATME can be limited by rating inflations, student resistance, and a lack of insight into complex team dynamics.

Although learning strategies of these general pedagogical approaches are designed to be applicable across a wide range of learning contexts – an undeniable strength – they often lack specific guidance on how to build teamwork competencies. For example, although TBL's team structure provides a context for the development of teamwork competencies, it does not include specific tools for students to monitor or enhance these competencies. As a result, considerable expert customization would be required to adapt these strategies for explicit teamwork competency training.

In summary, while the existing pedagogical approaches addressing the issue of advancing teamwork competencies yield valuable insights, none of them fully meets the current need for training students' teamwork competencies within the broader academic context. Also, none of these existing approaches clearly aligns with Marks et al.'s (2001) model describing the correspondence between teamwork processes and corresponding competencies. The gaps identified in existing teamwork training approaches suggest a critical need for a new Training Protocol© that would provide students with: (1) a theoretical framework to inform them about teamwork processes and establish standards of effective teamwork which would guide their assessment of teamwork experiences; (2) multiple opportunities to engage in the iterative cycle of planning, action, reflection, and adjustment; and (3) tools for reflecting on their teamwork competencies and outcomes.

4 Teamwork Competency Training Protocol©

The TWC Training Protocol© is based on models of effective team processes and practices (Kemmis and McTaggart, 2000; Kuit et al., 2001; Marks et al., 2001) and targets the knowledge, skills, and attitudes teams need to plan, implement, and manage their work effectively. It provides training to equip students with the foundational knowledge necessary to understand the tenets of effective teamwork. It incorporates multiple cycles of practice and structured reflection that enhance metacognition, thus enabling students to develop awareness of their teamwork processes and competencies while identifying areas for improvement and learning to problem-solve.

The TWC Training Protocol© is a multi-step, reflective plan-act-assess-adjust process that higher education instructors can integrate into any substantial group project involving student collaboration in small teams (typically 4–5 students) over an extended period of time (e.g., 6–8 weeks of a 15-week semester). It is designed for college educators without specialized expertise in teamwork training who aim to offer students meaningful opportunities to develop and strengthen their teamwork competencies. Adaptable across a wide range of courses, the TWC Training Protocol© is intended for use in semi-structured team projects requiring coordination, creativity, and collaboration. The protocol requires minimal class time, as most activities take place outside of class, with in-class time used primarily for teams to plan and assess their progress.

The TWC Training Protocol© incorporates several key learning principles that are designed to enhance its effectiveness: (1) *knowledge acquisition* – introduction to teamwork concepts; (2) *practice* – engagement in assigned teamwork tasks; (3) *reflection* – periodic structured individual self and team evaluation along with team discussions to evaluate progress; (4) *assessment/feedback* – teams' responses to their self-evaluations; and (5) *action research* – a cyclical process encompassing steps 1–4 and a plan for target improvements in the next iteration.

The TWC Training Protocol© promotes the development of teamwork competencies through multiple training elements. It includes a planning phase and three stages of practice, each culminating in the submission of a deliverable, individual and team reflections, self-and peer-behavior ratings, and an improvement plan for the next stage. In the following sections, we provide a detailed description of the protocol (section 4.1), its theoretical

foundations (section 4.2), strategies for implementing it (section 4.3), and evidence of its effectiveness (sections 5.1–5.2).

4.1 Establishing a foundation for effective teamwork

Setting students up for success is a critical aspect of the protocol and involves both knowledge delivery and planning processes. The protocol begins by guiding students in understanding the key components and standards of effective teamwork, while introducing strategies to foster and sustain it. To achieve this goal, students complete an online training called the *Teamwork Competency Training© Modules*, individually as a course assignment, typically before being assigned to teams. The training modules, which take approximately 35–45 min to complete, consist of four short lessons that focus on what makes a team effective, how to establish a cohesive team, and how to avoid common teamwork challenges. The modules also introduce students to the rationale behind the protocol activities. The training modules were designed based on research on teamwork in higher education, as well as models of effective teamwork from the organizational literature (e.g., Hillier and Dunn-Jensen, 2013; Kemmis and McTaggart, 2000; Kuit et al., 2001; Loughry et al., 2014; Marks et al., 2001; Ohland et al., 2012; Scott-Ladd and Chan, 2008). They cover the skills, knowledge, and attitudes essential for successful teamwork and serve as the first step in the protocol, preceding all other team-related activities.

Once students are placed into teams and introduced to their assigned group project, they are provided class time to get to know each other and plan how to collaborate effectively. In the training modules, students learn that clearly defining their team's goals and setting explicit expectations for collaboration are critical to their success. To support this process, students create a *Team Charter*, which offers a structured framework for teams to initiate this important conversation. The Team Charter requires each student to reflect on their perceived strengths and weaknesses as a team member. It also prompts teams to identify shared values, set goals, and establish metrics for assessing their success. The Team Charter guides teams in developing a set of working agreements. Once this process is complete, each student signs the document to signal their commitment to the agreement and records an individual goal for contributing to the team. The Team Charter yields three critical outcomes: (1) the team's initial goals; (2) their working agreements; and (3) each member's individual contribution goal.

There are many team charter templates available in the literature (Aaron et al., 2014; Andrade et al., 2023; Dougherty et al., 2018; Kirkpatrick et al., 2022; Tornwall et al., 2021) that provide a structure for guiding student teams through articulating their goals and norms. We created a team charter form by drawing on ideas from several different templates (e.g., Dougherty et al., 2018; Hillier and Dunn-Jensen, 2013) to guide students through the following activities: (1) sharing their contact information; (2) identifying their individual strengths and weaknesses to help the team members better understand and support each other; (3) discussing their values and setting team goals; (4) establishing agreements on team functioning, including rules and expectations to guide their collaboration; and (5) deciding on the strategies for holding each other accountable.

4.2 Let the teamwork begin

Once the team charter is established, teams begin working on their projects. Under the protocol, the team project is divided into three stages, with a deliverable due at the end of each stage. This structure allows teams to pause between stages to assess their teamwork and receive instructor feedback on their deliverables. These stages, along with the reflections that follow each, are iterative, enabling repeated practice and leading to mastery over time. This approach allows students to make targeted adjustments, refine their teamwork competencies, and apply concepts introduced in the training modules. The reflections are scaffolded through two components: a survey in which each team member individually reports on team processes, and a team discussion report that guides teams in assessing their teamwork and planning targeted adjustments to improve their team processes. Additionally, students complete a survey evaluating both their own behaviors and those of their teammates, using a scale anchored by descriptions of effective and ineffective behaviors.

The *Individual Teamwork Reflection* form includes a survey and a set of questions that guide students to individually rate and reflect on key aspects of their team's processes. The form incorporates descriptions of team behaviors adapted from Hillier and Dunn-Jensen's (2013) Formal Team Assessment Form and uses the same 1–10 rating scale with behavioral anchors at each end. However, our Individual Teamwork Reflection form was modified to include a reflection question after each rating, prompting students to consider their team's performance on each specific aspect of teamwork. The Individual Teamwork Reflection was administered as an online Google Form, completed by students outside of class at the end of each teamwork stage. It focuses on 12 aspects of teamwork that students are asked to reflect on and rate based on their team's performance: purpose, participation, communication, respect, conflict management, decision-making, time management, shared leadership, flexibility and creativity, responsibility, team agreements and norms, and quality results. Previous research suggested that the act of reflecting on and assessing one's performance is associated with improved performance over time (Hirsch and McKenna, 2008; Kemmis and McTaggart, 2000; Marks et al., 2001; Salas et al., 2018; Welp et al., 2018).

At the end of each teamwork stage, students also complete *Self and Peer Ratings* by completing the CATME Peer Evaluation (Ohland et al., 2012), assessing both their own and their teammates' behavior on a scale from 1 to 5. Like the Individual Teamwork Reflection, this survey is also completed outside of class and provides students with clear descriptions of effective and ineffective teamwork behaviors, thus establishing a shared standard for team member excellence. These ratings also serve as an additional opportunity for students to reflect on their own contributions and those of their teammates. Both the Individual Teamwork Reflection and the Self and Peer Rating survey must be completed before the team assembles for the final activity of the current stage – the whole Team Reflection.

The *Team Reflection* involves a team discussion of their performance as a team, completion of a brief report, and the development of an action plan for more effective teamwork in the subsequent stage. The Team Reflection report form follows a structure similar to Hillier and Dunn-Jensen's (2013) Formal Team Summary Form, but it was modified to align with the goals of the TWC Training Protocol© and includes an action planning activity.

To complete the Team Reflection, teams typically meet in class and discuss each member's individual ratings of the team's performance and

reflect on what went well and what could be improved during the most recent stage of the team project. These discussions are intentionally structured to focus on teamwork rather than the tasks involved in completing the project. Following this discussion, teams respond to a set of guided questions to document the results of their discussion in a brief report. Like the Team Charter, the Team Reflection report form is a collaborative document completed by the entire team. It is designed to help students integrate insights gained from the Individual Teamwork Reflection forms and facilitate consensus on the team's strengths, areas for improvement, and overall performance. Based on this analysis, the team collaboratively develops an action plan to improve its processes and enhance their future performance.

Creating and engaging in targeted improvement plans through iterative cycles of action, reflection, assessment, planning, and implementing is a well-documented strategy for improving team performance (Hillier and Dunn-Jensen, 2013; Marks et al., 2001; Salas et al., 2018). This strategy is applied across the three stages of teamwork within a given project to support the development of students' teamwork competencies. The final Team Reflection (completed at the end of stage 3) differs slightly from the Team Reflections of the first two stages of the protocol. Instead of creating an action plan, teams are asked to share their final thoughts on teamwork and reflect on their experience participating in this protocol.

4.3 Implementing the TWC protocol

For optimal team dynamics, teams should consist of 4–5 students – large enough to ensure diversity, yet small enough to foster meaningful interaction and collaboration. To promote balanced and equitable teamwork, instructors should assign students to teams to avoid pre-existing alliances that may disrupt team dynamics. Our collaborators have found that meeting these guidelines is generally straightforward and manageable in most classroom settings.

The most significant challenge for instructors in implementing the TWC Training Protocol© is to design content-specific teamwork tasks for students to complete. The project should span at least 6 weeks to allow sufficient time for students to practice and develop the targeted teamwork competencies. To structure the learning process effectively, the teamwork project must include three distinct stages, each culminating in a deliverable (e.g., a plan, supporting research, and a final report). This structure allows time for reflection and adjustment between stages, while also generating outputs that can be used for both team and instructor evaluation. Alternatively, three smaller projects may be assigned, as long as each requires meaningful interdependence among team members. To ensure a smooth implementation, task specification and team assignments should be finalized before the start of the teamwork training. Once instruction begins, the instructor can rely on the protocol's training materials and assessment forms to guide the teamwork competency component of the course, allowing them to focus their attention on evaluating the academic content of the teams' work. Importantly, the TWC Training Protocol© is content-neutral and can be implemented in courses across any discipline in higher education.

The training materials and assessment forms include the Teamwork Competency Training© Modules, the Team Charter, the Individual Teamwork Reflection Form, the Self and Peer Ratings survey, and the Team Reflection document. These materials can be obtained by contacting the corresponding author.

5 Assessing feasibility and perceived effectiveness of the TWC Training Protocol©: a pilot study on the implementation feedback

A public university in Malaysia and a public university in the Northwestern U.S. participated in a pilot study assessing the feasibility and perceived effectiveness of the TWC Training Protocol© based on instructors' and students' feedback. This study received exempt status from (institution)'s IRB.

5.1 Instructors' feedback

The following data were collected between October 2022 and May 2023. Thirteen instructors (five from Malaysia and eight from the U.S.) who implemented the TWC Training Protocol© in their classes provided both quantitative and qualitative feedback. On average, the instructors had 13.08 ± 9.28 years of teaching experience and had taught 6.85 ± 6.19 courses using student teams. These instructors implemented the TWC Training Protocol© in courses from the following disciplines: mathematics, construction management, educational studies, multimedia studies, writing studies, engineering, radiology, business, and philosophy.

Before implementing the protocol, instructors received training in best teamwork practices, strategies for facilitating effective teamwork in their courses, and the content of the TWC Training Protocol©.

5.1.1 Quantitative data

Participating university instructors were asked to rate on a scale from 1 to 5 (1 being the lowest and 5 being the highest), their perceptions before and after the implementation of the TWC Training Protocol© on the following aspects of their experience: (1) difficulty in organizing/structuring teamwork in their course(s) (ORG); (2) difficulty in managing teamwork in their course(s) (MNG); (3) perceived social loafing (free riding) in student teams (SLF); (4) perceived interpersonal conflict in student teams (IPC); (5) perceived team trust and cohesion in student teams (TRC); (6) perceived students' satisfaction with teamwork (SST); (7) perceived quality of students' teamwork products (QLT); (8) perceived students' teamwork competencies by the end of the team project(s) (CMP); (9) the instructor's satisfaction with students' teamwork processes (ISP); and (10) the instructor's satisfaction with students' teamwork outcomes (ISO) (see [Figure 1](#)).

Wilcoxon matched pairs test was performed using SPSS software (version 29) because most of the data were non-normally distributed ($p < 0.05$ on the Kolmogorov–Smirnov test). The results (see [Table 1](#) for data) showed a significant decrease in instructors' ratings before

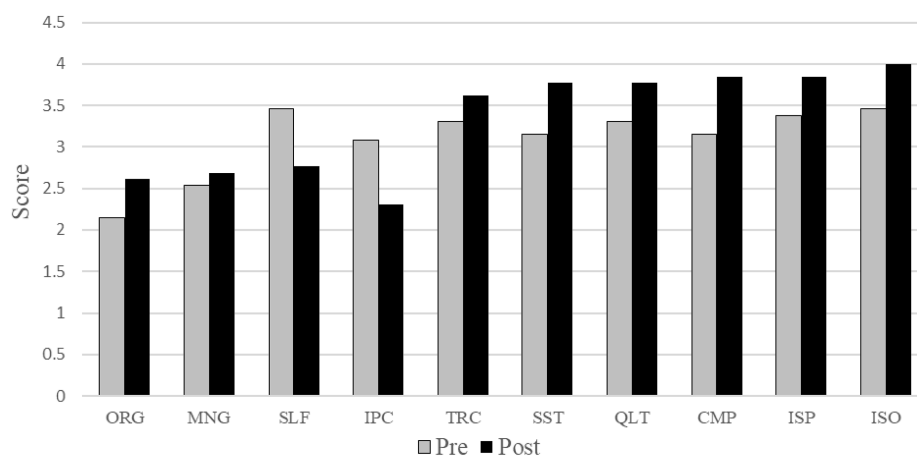


FIGURE 1

Change in instructors' perceptions of students' teamwork from before (pre) to after (post) the TWC training intervention.

TABLE 1 Instructors' quantitative feedback (M = Mean and Mdn = Median) before and after the implementation of the TWC Training Protocol©.

Rated experience	Before the TWC training	After the TWC training
Difficulty in organizing/structuring teamwork	$M_0 = 2.15, Mdn_0 = 2.00$	$M_1 = 2.62, Mdn_1 = 3.00$
Difficulty in managing teamwork	$M_0 = 2.54, Mdn_0 = 3.00$	$M_1 = 2.69, Mdn_1 = 3.00$
Social loafing in student teams	$M_0 = 3.46, Mdn_0 = 3.00$	$M_1 = 2.77, Mdn_1 = 3.00$
Interpersonal conflict in student teams	$M_0 = 3.08, Mdn_0 = 3.00$	$M_1 = 2.31, Mdn_1 = 2.00$
Team trust and cohesion in student teams	$M_0 = 3.31, Mdn_0 = 3.00$	$M_1 = 3.62, Mdn_1 = 4.00$
Students' satisfaction with teamwork	$M_0 = 3.15, Mdn_0 = 3.00$	$M_1 = 3.77, Mdn_1 = 4.00$
Quality of students' teamwork products	$M_0 = 3.31, Mdn_0 = 3.00$	$M_1 = 3.77, Mdn_1 = 4.00$
Students' teamwork competencies	$M_0 = 3.15, Mdn_0 = 3.00$	$M_1 = 3.85, Mdn_1 = 4.00$
Instructor's satisfaction with teamwork processes	$M_0 = 3.38, Mdn_0 = 3.00$	$M_1 = 3.85, Mdn_1 = 4.00$
Instructor's satisfaction with teamwork outcomes	$M_0 = 3.46, Mdn_0 = 4.00$	$M_1 = 4.00, Mdn_1 = 4.00$

and after using the TWC Training Protocol® for perceived social loafing ($z = -2.46, p = 0.014$) and interpersonal conflict in student teams ($z = -2.31, p = 0.021$), and a significant increase in perceived students' teamwork competencies by the end of the team project(s) ($z = -2.31, p = 0.021$). A marginally significant increase was observed in perceived students' satisfaction with teamwork ($z = -1.93, p = 0.054$) and in instructors' satisfaction with students' teamwork outcomes ($z = -1.90, p = 0.058$). Other aspects of instructors' perception on teamwork showed no significant changes due to the protocol implementation: (1) difficulty in organizing/structuring teamwork in their course(s) ($z = -1.61, p = 0.107$); (2) difficulty in managing teamwork in their course(s) ($z = -0.63, p = 0.527$); (3) perceived team trust and cohesion in student teams ($z = -0.79, p = 0.429$); (4) perceived quality of students' teamwork products ($z = -1.61, p = 0.107$); and (5) instructors' satisfaction with students' teamwork processes ($z = -1.51, p = 0.131$).

5.1.2 Qualitative data

Participating university instructors were also asked the following open-ended questions: (1) What was your overall experience implementing the Teamwork Competency (TWC) Training Protocol® in your classes? (2) Please provide more details on your perception of your students' experience using the Teamwork Competency (TWC) Training Protocol®; and (3) Please provide more details on your general feelings and recommendations regarding the Teamwork Competency (TWC) Training Protocol®. The qualitative feedback obtained was categorized as: (1) benefits of implementing the TWC Training Protocol®; (2) challenges of implementing the TWC Training Protocol®; and (3) suggestions for implementing the TWC Training Protocol® (see Table 2). Thematic analysis was used to identify recurring themes within each category. The main themes that emerged from the qualitative coding of instructors' feedback are outlined below.

Instructors' reflections revealed a combination of positive experiences and challenges in implementing the TWC Training Protocol®. They appreciated the initial training materials and the opportunity for students to create team charters, which provided a strong foundation for student teamwork and additional guidance. Several instructors noted that after using the protocol, students became more responsible, engaged, and willing to participate in teamwork. They highlighted how the TWC training encouraged students to take teamwork more seriously, with one instructor observing that teams worked more effectively from the start of the semester compared to previous years when the protocol was not implemented. The protocol was also praised for its ease of implementation and its clear impact on improving team dynamics and reducing conflict. The structured approach, which included goal-setting and regular reflection, was seen as a key factor in enhancing team cohesion and overall student performance.

Instructors also commented on the benefits of team reflections, noting that they helped students address issues and adjust throughout the project. Some instructors mentioned that giving students time to reflect on their teamwork reduced stress and helped students become more proactive in addressing conflicts. The structured discussions around teamwork allowed for deeper student engagement and better outcomes, as students took ownership of their work and worked collaboratively to meet shared goals. Many instructors expressed appreciation for how the TWC protocol

enhanced students' ability to communicate and collaborate effectively. They noted that teams that followed the protocol and thoughtfully completed all the prescribed tasks showed outstanding performance, while teams with a less serious attitude demonstrated suboptimal performance.

However, instructors also identified some challenges. A common concern was the potential for student burnout due to the frequency of team reflections and the additional workload it created, especially in already demanding courses (e.g., those with a service component). Additionally, there were reports that some students struggled with open communication, particularly when it came to addressing conflicts or providing honest feedback to their peers. Instructors also mentioned the difficulty of integrating the protocol into shorter courses (e.g., 7-week rather than 15-week courses) or courses with tight schedules, where time for reflection and teamwork activities was limited.

In conclusion, while the TWC Training Protocol® was generally seen as a valuable tool for enhancing teamwork, instructors noted the need for adjustments, such as reducing the frequency of reflections or providing more flexibility in how the protocol is implemented. Despite these challenges, the overall feedback was positive, with instructors emphasizing the benefits of structured teamwork training in improving student collaboration, communication, and project outcomes.

5.2 Students' feedback

At the end of the semester, students who participated in the implementation of the TWC Training Protocol® were asked to provide their final thoughts and reflections on their teamwork experiences. The sample consisted of 320 students from Malaysia and 330 students from the U.S. Similar to the instructors' feedback, students' experiences were grouped into three categories: (1) benefits of the TWC Training Protocol® and lessons learned; (2) challenges of the TWC Training Protocol®; and (3) recommendations for implementing the TWC Training Protocol® (see Table 3). Thematic analysis of students' feedback was conducted to identify salient themes within each category. The main themes identified through the qualitative coding are summarized below.

In their reflections, students highlighted that the TWC protocol taught them the importance of clear goal-setting, open communication, and mutual respect among team members. They learned to manage conflicts respectfully, communicate effectively, and delegate tasks according to team members' strengths – essential competencies for future teamwork. Specifically, students noted that establishing clear *norms* for team functioning at the outset is crucial for project success. Additionally, the structure provided by the TWC protocol encouraged students to carefully *plan* each project before diving into the work. They learned to define the project's purpose, set clear team goals, and outline the tasks that needed to be completed. This type of pre-planning allowed students to evaluate the workload and set realistic goals. With a better understanding of the project's scope, they were able to assign tasks based on individual team members' strengths and weaknesses. Many students noted the value of open communication and discussions, which helped them get to know each other better and make more effective use of team members' expertise.

TABLE 2 Examples of instructors' perspectives on the benefits, challenges, and recommendations for implementing the TWC Training Protocol®.

Themes	Sample responses
Benefits of implementing the TWC Training Protocol®	
Positive impacts on students	<p>Malaysia</p> <p>"It is good practice to implement TWC because it teaches students how to be more outspoken when facing issues as a team."</p> <p>"Students showed good commitment and responsibility in completing the projects."</p> <p>"It really helped students reduce the conflict among team members."</p> <p>United States</p> <p>"Giving students time to reflect throughout the process may have reduced their stress regarding full participation by everyone."</p> <p>"I think the initial training was beneficial. It certainly helps to have more guidance and the chance to reflect on the process as students work through it."</p> <p>"It became more valuable as the project progressed. In the beginning, students did not really know what was expected. I believe it helped them formulate their ideas and take ownership of their work."</p> <p>"I think the team ratings of the work were helpful – I heard students disagreeing on how they were doing, which was great because they could see that not everyone was on board with the way things were progressing."</p> <p>"I am sure the fact that they rated each other influenced the amount of work they put in."</p> <p>"The students had better scaffolding in understanding the importance of teamwork, especially in identifying core values and setting personal goals for effectiveness within the teams. I think this was the greatest benefit."</p> <p>"The formal presentation of teamwork training helped students accept the team project as part of their formal education."</p>
Ease of implementation	<p>Malaysia</p> <p>"It was easy to implement the TWC Training Protocol®."</p> <p>"[It was a] very constructive and thorough process."</p> <p>"I did not have any problems while implementing TWC."</p> <p>United States</p> <p>"Implementing the protocol was only a minor lift compared to what I had previously done in this course."</p>
Improved team performance	<p>United States</p> <p>"The focus on teamwork allowed the teams to really work together in ways I have never seen before. I think that the students liked having a forum to talk about their experiences within the team."</p> <p>"I was surprised by how well the teams started. The biggest change compared to previous semesters when I did not implement TWC is that teams worked more effectively from the beginning, and it seems that they experienced less conflict."</p> <p>"The TWC had a clear and positive effect on the team performance."</p> <p>"Of the three groups, one group took it seriously and seemed to have meaningful conversations during their teamwork reflections. That group performed fantastically. Another group did not seem to take it seriously at all, which is unfortunate, as that was the group that failed to complete a major part of the group assignment. The third group seemed somewhere in between. I have noticed that students who expressed how much they enjoyed working with their teammates, in general, had a better ...experience than students who had teammate issues."</p> <p>"The students received higher grades, and I believe these reflected higher-quality collaboration and deliverables."</p>
General praise	<p>United States</p> <p>"Generally, I feel it was worthwhile to have teams go through the protocol."</p> <p>"I worried early on about the time the protocol would take away from instruction and meeting hours, especially since this is a hybrid class and a service course, which means we cover a lot of material. However, in the end, the protocol activities were very well spent time."</p> <p>"Overall, [it was] a positive experience."</p> <p>"I do really appreciate the team teamwork reflection, where the students got together to discuss teamwork and create an action plan. I plan to incorporate that into my regular curriculum moving forward. I really liked the post-reflection team discussions. Requiring the students to meet with each other (rather than using anonymous feedback via CATME) to discuss strengths, weaknesses, and next steps was helpful."</p> <p>"I am glad that I participated; I learned a lot from the process."</p> <p>"I was very grateful for the influence of the protocol. Thank you for giving students the opportunity to surface and articulate their goals and processes."</p> <p>"It was a great learning experience for me and the students."</p> <p>"Thank you for providing the TWC! It helped my class immensely."</p>

(Continued)

TABLE 2 (Continued)

Themes	Sample responses
Challenges of implementing the TWC Training Protocol©	
Burden on students	<p>Malaysia</p> <p>“Students felt a bit overwhelmed by the TWC protocol.”</p> <p>“Some students commented that there were too many team reflections.”</p> <p>United States</p> <p>“I believe the three reflection assignments were (almost?) identical. That felt a bit repetitive.”</p> <p>“The 12-question survey with short answers was criticized by the students as being excessive.”</p> <p>“The students felt over-surveyed and/or over-reflected.”</p> <p>“The length and frequency of the teamwork reflection assignment were burdensome for the students.”</p> <p>“I did have one student who informed me that she did not like the number of reflections and she felt like it was busy work. She mentioned that she had discussed this with others, and they concurred.”</p> <p>“For our class, the first deliverable and the first team reflection were somewhat rushed and not yet necessary – it seemed repetitive, and this probably gave everyone that initial impression as they were still getting familiar with the project. This was due to the [complex] nature of the project.”</p> <p>“I feel student perception was mixed, maybe leaning slightly toward the ‘this is a waste of time’ sentiment.”</p> <p>“By the end, students were tired of completing the many forms.”</p>
Difficulty of honest communication	<p>Malaysia</p> <p>“Despite explicit instructions to openly discuss any controversial situations within the team, students still preferred to avoid confrontation on the issues they were not happy with.”</p> <p>United States</p> <p>“Having students share and discuss their scores at each stage may not have had the impact it was intended to have. I know that one group in particular was hesitant to truly speak up within the group about the perceived lack of participation by some members. Confrontation is hard, and young people seem to avoid it these days. In fact, I do not think they know how to handle it!”</p>
Time requirements	<p>United States</p> <p>“This protocol had more teamwork-related assignments, which were difficult to integrate into the curriculum, considering it was a 2-credit course that was already a lot of work.”</p> <p>“Based on the schedule, there wasn’t enough time between the first and second deliverables for meaningful action.”</p> <p>“This was a lot for a seven-week course.”</p> <p>“A more experienced instructor with a rock-solid curriculum may have had more success than I did, but I found the pivoting and real-time demands of the task very challenging to meet. I do not regret the teamwork aspects of the course. I just needed to make space for group work very quickly, which meant less time for other important portions of the class.”</p>
Recommendations for implementing the TWC Training Protocol©	
Program-level	<p>Malaysia</p> <p>“If TWC practice becomes the norm in class, students may feel more comfortable expressing their concerns as team members in the future.”</p>
Class-level modifications	<p>Malaysia</p> <p>“More detail and interactive training could be provided.”</p> <p>United States</p> <p>“The number of team reflections could be reduced to two.”</p> <p>“A fast start, followed by a plateau with repetition. Perhaps a more scaffolded approach would keep the students more engaged.”</p> <p>“The averaging exercise the students did in class (combining their scores to make a group score) became tedious. Perhaps this could be automated.”</p> <p>“As the instructor, it would have been helpful to have access to the data in a way that could inform me about group dynamics. It was difficult to access, and I did not want to burden the students with more reflections on top of those they already had to complete.”</p>
Class-level customizations	<p>United States</p> <p>“I added a new feature this semester: an automatic grade drop of 10% per missed collaboration meeting. This provided an incentive for students to avoid disappearing, which had been my single biggest problem with teams. The combination of the protocol and the consequential new policy was a win-win. The students were more invested in their projects, and in the end, I believe, most of them were very proud of their work.”</p>

TABLE 3 Examples of students' perspectives on the benefits, challenges, and recommendations for the TWC Training Protocol©.

Country	Sample responses
Benefits of the TWC Training Protocol© and lessons learned	
MY	<p>Lower-division</p> <p>"Luckily, we did not have any "free riders" in our team, everyone was playing his/her role in this project."</p> <p>"This experience taught us how to cooperate with other members and work as a team with respect and tolerance."</p> <p>"Teamwork encourages personal growth, increases work satisfaction, and reduces stress."</p>
	<p>Upper-division</p> <p>"We have learned to be more considerate toward others, responsible while completing one's assigned tasks, and always help team members if they need help. We have also learned that all problems can be solved very efficiently if there is cooperation between team members."</p>
US	<p>Lower-division</p> <p>"This is like real teamwork in the workplace and gives us good experience in dealing with groups where each group member has needs and has to have a feeling of purpose."</p> <p>"We agree that this group was one of the best experiences with group projects we have all had. We had a lot of mutual trust and understanding for one another and had each other's back. Setting the rules and norms at the beginning of the class helped a lot at maintaining a good status within the group."</p> <p>"This experience has taught us how being in a like-minded group makes the group cohesive and makes the decision-making in the group a lot more fluid, reducing the amount of hiccups through our assignments."</p> <p>"All group members were invested in doing well, so natural leaders phased in and out as needed. Keeping up a flow of communication outside of email contributed to everyone's flexibility in terms of group structure and scheduling. We think we rocked it."</p> <p>"One of the main things that we have learned is that teamwork is much more fun and easier when the members are friends. We learned that once you build a respect for each other, you are able to more easily and effectively communicate, manage disagreements, and work around scheduling issues/picking up slack if someone else is unable to help."</p> <p>"This teamwork reduced burnout: team members could provide emotional support to each other and help each other if one member had a problem with their part. Moreover, teamwork helped us to solve problems through brainstorming with the team members."</p> <p>Upper-division</p> <p>"It became clear that the group's work will only be as good as the shared vision held by each member of the group. This shows us the importance of discussing early on what the expectations are for the quality of work we are looking to turn in."</p> <p>"This project completion was a big boost for our team, highlighting the importance of communication, goal-setting, and working together to achieve success. We learned to be open about any problems or challenges we face with tasks. These lessons have made us more proactive in dealing with issues and created a team where everyone's ideas are valued."</p> <p>"As a team, we feel that this experience has shown us that communication and respect are the keys to success. There have been communication hiccups but instead of allowing that to push us two steps back, a respectful conversation propelled us forward. We've learned that respect means being open and honest with your team about setbacks, just as much as the team being understanding toward each other's unique situations. In closing, our team shares the same sentiment that this team has been one of the most enjoyable and productive teams we have been a part of during our collegiate journey."</p> <p>"It is also important to set team goals and norms at the beginning of each project, so everyone has a clear understanding of what is expected of them. Finally, it's essential to understand that everyone has different strengths, so it's key to assign roles and responsibilities based on these individual strengths and weaknesses."</p> <p>"The decisions we make in the next step of this project are very important, so having more detailed and frequent discussions regarding those decisions helps to guide our design. Allowing other group members to be leaders for different tasks is important but sharing leadership for the entire project is critical for fairly splitting tasks."</p> <p>"Throughout this project, we have learned the importance of mutual clear purpose. Without clear purpose, it is difficult to make decisions, begin delegating, and make the first step. Clear purpose is the common denominator regardless of each individual group member's skills."</p>
Challenges of the TWC Training Protocol©	
MY	<p>Lower-division</p> <p>"It cannot be denied that we were awkward with each other at first but after a few times of meeting and talking, we clicked really well."</p>

(Continued)

TABLE 3 (Continued)

Country	Sample responses
US	<p>Lower-division</p> <p>“We were all a bit apprehensive about team projects and collaboration because of bad experiences with teams in the past, but the success of this project has helped us see what fostering positive collaboration is like.”</p> <p>“We have struggled to stick to our norms that we established at the beginning of the semester and this affected how we felt about our project assignments and presentations. Toward the end of the semester, we clarified our thesis, which helped us establish our purpose as a team, and made the deliverables easier to work on and complete with quality. We also started developing tighter timelines within the team which allowed us to review each other’s work and make any changes before the final submission deadline.”</p> <p>“In the initial stages of a new project, evenly distributing responsibilities can be challenging due to the unfamiliarity with the tasks at hand. However, as experience grows, it becomes more feasible to distribute roles effectively and articulate specific areas that require improvement. Regular check-ins play a crucial role in ensuring everyone is aligned with their tasks, allowing for a smoother and more coordinated workflow.”</p> <p>“There was some level of disconnect when it came to workflow because of disconnected schedules and also a mild lack of communication during some weeks. Outside of the communication disconnect during those weeks, the rest of the work was handled perfectly and it went well.”</p> <p>“Teamwork is difficult because of all the different parts it includes like absences, dividing work evenly, and having enough work for everyone in the group. This experience has allowed us to collaborate and listen to each other in order to work well together.”</p> <p>“Finding a good group of people to work with can be hard, but communication and respect can help make any group experience easier for everyone.”</p> <p>Upper-division</p> <p>“It was annoying to have to do so much reflection but we thought it actually helped and yielded a better team.”</p> <p>“Teamwork is a difficult thing to balance and equally splitting tasks takes work. Each assignment has unevenness, but being mindful of overall work is helpful when assigning smaller tasks.”</p> <p>“It was difficult to coordinate conflicting schedules and find common free time to collaborate.”</p>
Recommendations for implementing the TWC Training Protocol©	
MY	<p>Lower-division</p> <p>“It is important to conduct job distribution as early as possible, so that everyone has more time to complete his/her tasks (including the time for discussions to eliminate errors and improve the report).”</p>
US	<p>Lower-division</p> <p>“Perhaps we need a team building program in order to strengthen the bonding between the group members...”</p> <p>“There should be debriefs at the beginning or the end of meetings so that everyone is on the same page with what the other group members have completed.”</p>

Students also reflected that this upfront effort in planning helped them avoid potential misunderstandings and ensured everyone had a clear vision of what needed to be accomplished. The clarity provided by pre-planning also allowed teams to set realistic deadlines, anticipate challenges, and develop strategies to overcome them, fostering a sense of direction. Through these experiences, students learned to be *proactive* rather than reactive in their teamwork, developing critical thinking skills to anticipate the potential outcomes of their decisions, identify challenges, and recognize opportunities for improvement in advance. In addition to pre-planning, the TWC protocol emphasized regular reflections throughout the project. By reflecting on their work, students could learn from their mistakes, re-evaluate their strategies, and make necessary adjustments, leading to more efficient and successful project completion.

Throughout the multiple cycles of planning and reflection, students were encouraged to engage in open but *respectful communication*. Creating a safe space for expressing diverse ideas and opinions, and showing respect for differing perspectives, allowed students to bond and build trust, thus improving team cohesion – the

shared sense of unity and purpose within the group that drives them to stay together and collaborate (Casey-Campbell and Martens, 2009; Forsyth, 2021). Many students noted that forming strong bonds and friendships within the team made communication smoother and collaboration more enjoyable. Several students emphasized that mutual respect and understanding were crucial for building a cohesive team, as these qualities helped them navigate conflicts and scheduling issues more effectively.

Furthermore, students emphasized the value of *shared leadership* in teamwork, noting that allowing different members to take on leadership roles for specific tasks was crucial for an equitable division of labor and a sense of ownership. Students also appreciated that shared leadership made team dynamics more fluid, allowing natural leaders to emerge when needed. This fostered a more productive, flexible workflow and a positive team environment where everyone contributed meaningfully. Additionally, the TWC protocol enhanced accountability within the team: promoting regular meetings and progress discussions where each member reported on their assigned tasks, effectively reduced free-riding, and promoted individual responsibility.

The theme of *backup behavior* emerged as a critical aspect of effective teamwork in student reflections. Backup behavior refers to the willingness of team members to step in and support one another when someone is facing challenges, unable to complete a task, or falling behind (Gao et al., 2014; Porter et al., 2003). Students highlighted that being proactive in offering help, whether by picking up slack or assisting with difficult tasks, was essential for maintaining team momentum and ensuring project success. Many students emphasized that these behaviors fostered a sense of shared responsibility, with the entire team working together to overcome obstacles rather than leaving individual members to struggle alone. This approach created a supportive environment that enhanced trust and collaboration.

Interestingly, some instructors (see section 5.1.2.) expressed concerns that the multiple reflections required by the TWC protocol might lead to burnout among students. However, this concern was almost non-existent in students' responses. Only one team mentioned the excessive number of reflections, but they concluded that the reflections ultimately improved their team processes and outcomes. Indeed, students recognized the value of frequent discussions and reflections, which helped them stay on track and adapt to various challenges. Additionally, students noted that well-structured teamwork helped reduce their stress and burnout.

Importantly, even when students described specific challenges they faced in their teamwork, their attitude remained very positive, suggesting a *growth mindset*. They concluded that the difficulties they encountered enhanced their teamwork competencies and learning outcomes, promoted personal growth, and prepared them for future success in the workplace. The ability to resolve teamwork challenges through respectful, open conversations empowered the students. Some came into the TWC Training Protocol© with negative prior teamwork experiences and significant apprehension toward working in teams. However, most teams in this study reported a positive experience that eliminated their initial reservations and motivated them to engage in future teamwork.

6 Discussion

The main purpose of this study was to evaluate the feasibility and perceived effectiveness of the TWC Training Protocol© using feedback from both instructors and students. Feasibility was assessed through qualitative feedback, whereas perceived effectiveness was evaluated using both quantitative and qualitative measures.

The current findings support the *feasibility* of implementing the TWC protocol across diverse academic and cultural contexts, as instructors from the U.S. and Malaysia reported that it was easy to integrate the protocol into existing curricula without significantly altering course structure or increasing workload. Despite instructors' minor concerns about the frequency of reflections used in the teamwork training, both instructors and students found the structured format of the training manageable. For instructors, implementing the TWC protocol did not present any challenges in organizing, structuring, or managing teamwork; instead, it streamlined teamwork processes in their classrooms, allowing them to focus on designing meaningful teamwork tasks, interpreting the outcomes, and responding to teams' feedback as needed. Moreover, students reported lower stress and greater enjoyment in teamwork, with many expressing a shift from negative to positive attitudes about collaboration with

others – a finding consistent with previous research on the role of effective teamwork on student engagement and satisfaction (Fung, 2014; de la Torre-Ruiz et al., 2014; Scott-Ladd and Chan, 2008; Zhou and Pazos, 2021).

There is also clear evidence for the *effectiveness* of the TWC Training Protocol©, as indicated by positive feedback from both instructors and students. Instructors reported that implementing the TWC protocol significantly improved students' teamwork competencies, encompassing an understanding of effective team processes, as well as skills in planning and coordinating, goal setting, collaborative problem-solving, performance monitoring, communication, conflict resolution, building trust and team commitment, and backup behavior (Campbell et al., 2024). The protocol also alleviated significant problems that instructors often face while implementing teamwork in their courses, such as social loafing (Hall and Buzwell, 2013; Jassawalla et al., 2009; Luo et al., 2021) and interpersonal conflict (De Dreu, 2008; Konrad et al., 2020). Although caution should be applied while interpreting these results because of the small sample size, the current findings align well with previous research reporting that structured teamwork, such as using team charters and action research, enhances communication, reduces conflict, fosters trust and collaboration, and improves students' engagement, accountability, learning outcomes, and overall teamwork satisfaction (Campbell et al., 2023; Dougherty et al., 2018; Pertegal-Felices et al., 2019; Scott-Ladd and Chan, 2008).

Students' feedback suggested that the TWC protocol promoted essential teamwork competencies, such as communication, goal setting, mutual respect, conflict management, shared leadership, and backup behavior. Students noted that the structured planning and reflection phases enhanced clarity, cohesion, and accountability within teams, while reducing misunderstandings and problems with free-riding. These findings reinforce previous research highlighting the positive impact of structured teamwork (Campbell et al., 2023; Dougherty et al., 2018; Hillier and Dunn-Jensen, 2013; Marks et al., 2001; Pertegal-Felices et al., 2019), shared leadership (McIntyre and Foti, 2013; Wang et al., 2014; Zhu et al., 2018), team cohesion (Al-Rawi, 2008; Fung, 2014; McEwan, 2020), and backup behavior (McIntyre and Salas, 1995; Porter et al., 2003; Zhou and Pazos, 2021) on team effectiveness, collaboration, engagement, and overall satisfaction with teamwork. Students also indicated that the iterative reflection cycles helped them identify and correct team issues, which supports findings from action research emphasizing the role of reflective practice in developing metacognitive awareness and adaptive teamwork processes (Kemmis and McTaggart, 2000; Marks et al., 2001; Scott-Ladd and Chan, 2008). In summary, the TWC Training Protocol© offers instructors and students a structured way to improve teamwork competencies that effectively integrates relevant, evidence-based theory with iterative cycles of practice, reflection, and refinement to ensure optimal teamwork experience and outcomes.

Despite the apparent feasibility and effectiveness of the TWC Training Protocol©, there is still work to be done. While the protocol was generally regarded as a valuable tool for enhancing teamwork, instructors identified areas for improvement, such as reducing the frequency of reflections or providing greater flexibility in how the protocol is implemented. Thus, future directions include refining the protocol by streamlining reflection activities and accommodating shorter course formats. Additionally, there is a need to develop platforms that facilitate the dissemination and further testing of the

protocol. Further research should also explore long-term impacts of the TWC training on students' teamwork competencies and further assess its scalability across diverse disciplines, institutions, and countries. That being said, the TWC Training Protocol© presented here makes significant progress in addressing a critical gap in college-level educational capacity.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Institutional Review Board, Boise State University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their verbal informed consent to participate in this study.

Author contributions

CC: Validation, Conceptualization, Resources, Supervision, Methodology, Data curation, Investigation, Software, Writing – original draft, Funding acquisition, Writing – review & editing, Project administration. IB: Conceptualization, Software, Visualization, Writing – original draft, Investigation, Validation, Formal analysis, Writing – review & editing, Data curation, Methodology. SC: Conceptualization, Methodology, Supervision, Writing – review & editing, Writing – original draft, Project

administration, Visualization, Data curation, Resources, Validation.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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