

# Is an Effective Team an Equitable Team?

## Protocol for a Scoping Review

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**Abstract**—This full paper sets out a methodological protocol for conducting a scoping review of literature relating to teamwork effectiveness and equity. The goal of the study is to understand how academic discourse over the five-year period prior to the study being carried out has conceptualized teamwork success in educational and professional contexts, and to what extent equitable team practices are embedded within such conceptualizations. In line with ongoing initiatives to promote transparency in research, this protocol paper is intended for dissemination prior to the conduct of the study itself. The research context, questions, and rationale are set out, and a detailed methodology described, outlining procedures for data retrieval, screening, extraction, and analysis. The paper concludes with an outline of intended reporting methods for the study, including the reporting of deviations from the procedures set out herein. This paper contributes to the scoping review methodology, and especially its application in the field of engineering education research and education research more broadly.

**Keywords**—*scoping review, teamwork, equity, effectiveness*

### I. INTRODUCTION

This paper sets out a methodological protocol for conducting a scoping review intended to systematically survey the literature in a number of fields that touch on teamwork effectiveness and equity. Both the scoping review itself and this protocol are designed in accordance with current methodological guidance: the Preferred Items for Systematic Reviews and Meta-Analyses<sup>1</sup> extensions for scoping reviews and protocols (PRISMA-ScR and PRISMA-P, respectively). The scoping review is designed to provide a robust conceptual framework to underpin research into the objectives of team-based task assignment, and indicators of successful teamwork outcomes that go beyond task completion. In this regard it might also be regarded as a ‘mapping’ exercise, designed to “clarify key concepts and definitions in the literature” and “identify key characteristics or factors related to a concept” [1]. In addition to these more general goals, the review seeks especially to understand the inter-relations between *effectiveness* and *equity* in teams, and how these are linked to team outcomes and indicators of success.

The review has emerged from ongoing research in the field of Engineering Education; however, it is designed to be

transdisciplinary in scope in order to understand and synthesize conceptualizations of teamwork in a broad array of contexts, both educational and organizational. It is not intended to find definitive answers to the question of ‘What makes a team effective?’, but to understand a range of different conceptualizations and assumptions of team processes and characteristics. Despite an unquestionably comprehensive array of extant research, especially in the facilitation of interdisciplinary team collaboration in the sciences as collected by the Science of Team Science community, we have yet to find a review undertaken on these terms.

The following protocol is based on the stipulations of the PRISMA-P extension, although as PRISMA-P is intended to apply to systematic evidence synthesis, especially within health and medical research, some items are unnecessary for the intended scoping review. This document outlines the rationale for the study and the choice of method, before setting out the elements of the protocol, including database selection, search strategy, inclusion criteria, and analytical methods. Following recent trends driven by an effort to promote academic transparency, the protocol itself is presented for dissemination as a stand-alone paper prior to undertaking the study. This step is intended to encourage rigor in research design and ensure that the research process follows a carefully pre-planned structure. Protocol publication also enables methodological procedures to be recorded in a level of detail that may be precluded by space constraints in subsequent outputs reporting on the findings of the review. It is for these reasons that this protocol is presented as a full research paper and not a work-in-progress: protocol development is regarded as a distinct project phase with its own outcomes, as in [2][3].

### II. RATIONALE AND RESEARCH QUESTIONS

Teamwork is a critical skill in professional engineering environments. Project-based, team-based pedagogies are commonly used in engineering education, operating on two levels: functioning as an effective learning tool in their own right, and developing teamwork skills for later use in the profession [4]. Their use is not confined to engineering education, although engineering represents a use case in which the professional accrediting bodies explicitly recognize the

<sup>1</sup> [www.prisma-statement.org](http://www.prisma-statement.org)

importance and value of teamwork skills [5]. Project-based team-based work takes the form of a task that can best (or indeed only) be completed by means of genuinely interdependent collaboration. Task completion is generally the primary goal of the activity: a successful teamwork outcome is a product of some sort that fulfills task criteria and specifications.

A substantial body of literature well beyond engineering education explores the characteristics of “effective” teams. Such work looks more deeply than simply assessing task outcomes: [6], for example, presents a mathematical formula representing effectiveness as a function of performance (i.e., quality of task outcome), behaviors, and attitudes. Nevertheless, the focus of this line of research is often the effectiveness of the team in relation to task completion, simply because “[t]eams exist to complete tasks” [7].

To a greater or lesser extent depending on the context, however, the team task may also be expected to develop key skills in team members, individually and collectively. A successful teamwork outcome from this perspective involves the personal and professional development of team members. Skills may be related to the field and the task—such as developing proficiency with Computer-Aided Design software—or they may be communication, mediation, and evaluation skills related to teamwork itself. Inequitable team practices, in which the participation and contribution of particular team members is minimized or constrained, will lead to these developmental outcomes being inconsistent across team members, potentially in ways which systematically disadvantage team members with certain demographic characteristics. It is theoretically possible that a team that might be considered unsuccessful from this perspective—a team in which some individuals do not obtain the developmental benefits of the task—may nevertheless go on to produce a high-quality task product, presenting the outward appearance of a successful and effective team, masking fundamental inequities.

This latter notion is a substantial part of the rationale for this proposed review, when reformulated as a question: to what extent are effective teamwork and equitable teamwork separable? That is, to what extent do equitable team practices enhance team performance? Do inequitable team practices necessarily hinder successful task completion? Are there extant theoretical frameworks that measure team effectiveness primarily in terms of the personal growth of team members? Gaining an understanding of the inter-relationships between the two concepts as theorized in prior literature will provide a firm theoretical foundation for future research into, and implementation of, team-based learning in engineering education and beyond.

Following these discussions, the specific research questions to be addressed in the scoping review are as follows:

- How are notions of team success conceptualized and operationalized in the literature?
- How are notions of task completion, team member experience, and personal growth related?
- How is equity conceptualized in a teamwork context, and what is the role of equity among team members in the conceptualization of success?

- How do notions of team success differ between professional and educational contexts?

#### A. *Why a Scoping Review?*

A scoping review is a type of systematic literature review and synthesis that provides a means of establishing a representative knowledge base. Like systematic literature reviews, scoping reviews begin by casting a wide net in a number of selected academic databases, then filtering the results by applying specified inclusion criteria, charting the data, synthesizing the findings, and determining next steps based on the findings [8].

Unlike systematic reviews, scoping reviews are less likely to be concerned with evidence synthesis or meta-analysis, especially of a quantitative nature. Whilst scoping reviews may be interested in the findings of the sources surveyed, the guidance recommends that this does not involve “anything more than basic descriptive analysis (i.e., frequency counts of concepts, populations, or location of studies)” [1]. A key difference is that a systematic review sums up the “best available research on a specific question” [9] whereas scoping reviews map the current body of literature in a topic and focus on either a descriptive overview of the findings as a whole, or on surveying the conceptual frameworks underlying the topic.

The increasing popularity of scoping reviews over the last decade has led to efforts to establish a standardized methodological framework and best practice guidelines. A seminal paper in this regard is [10], which observed a lack of uniformity amongst the emerging scoping reviews [1]. The authors of [10] noted a need for uniformity, reporting quality, and reporting transparency. Their paper also led to increased efforts in establishing clear guidelines. [11] built upon the methodological framework proposed in [10] by identifying the challenges of its current state and where it could be enhanced. The status of scoping reviews as a sub-type of systematic reviews is acknowledged in the development of a scoping-review-specific extension of existing guidance for systematic reviews—the Preferred Items for Systematic Reviews and Meta-Analyses (PRISMA-ScR). These guidelines were established in 2018 as a derivation from systematic review guidelines, demonstrating the epistemological commonalities as well as the diverging goals of the two methodological cousins [8].

It is this latter function of a scoping review which makes it an ideal choice for present purposes. The ability to make statements about the state of academic discourse around the focal topics, supported by a search strategy that enables such statements to be characterized as broadly representative, will provide a valuable and robust theoretical foundation for work investigating teamwork in engineering education, especially for considerations of equity in this space.

### III. PROTOCOL COMPONENTS

This protocol includes the following components, following the PRISMA-P guidance: eligibility criteria, search strategy (including information sources and search terms), screening and data extraction procedures, analytical methods, and reporting strategies. A flow diagram visualizing the protocol can be seen in Figure 1. At the time of writing the steps outlined in this protocol have not been carried out; as mentioned above, this

paper serves to preserve decisions made at the planning stage in order to promote transparency and provide a point of reference for later reflection.

#### A. Eligibility criteria

The review will be confined to peer-reviewed academic literature and conference proceedings. Items for inclusion may be primarily empirical or theoretical, assuming that empirical studies make judgments, implicit or explicit, as to the nature of team success. This review will be limited to studies in which the unit of analysis or discussion should be a team of 3-8 members engaged on a collaborative project over an extended period of time, or an individual whose experiences within such a team are under investigation. These criteria are designed to exclude a number of peripherally-related team-like configurations such as pair-work, ad hoc group work, or team situations in which members produce individual outcomes.

As the review is concerned with the current academic discourse around the focal concepts, a five year time span will be imposed on candidate items, from January 2017 until December 2021. Although this ostensibly excludes influential theoretical work from before 2017, it is anticipated that such work will be invoked and described in more recent studies that the time span will capture. It is possible that such prior work may be accessed during analysis to provide context and clarification to derived concepts identified in the data.

#### B. Constructing the Search Strategy

The search strategy requires decisions to be made with regard to two main methodological components: the selection of academic databases to search, and the construction of search terms. Both of these aspects were developed in consultation with information specialists at the University of Michigan Library, as suggested in [1], and in discussion between all four authors. There is no definitive guidance with regard to the number of items sought at each stage of the process. This is determined instead by a combination of contextual factors, including the breadth of the topic, disciplinary cross-cutting, and pragmatic considerations of resource availability. The authors of [12] retrieve 1072 search results, before reducing this number by screening titles and abstracts to a final set of 37 studies for analysis. In [13] the corresponding numbers are 106 and 10 due to a more narrowly-focused field of inquiry. The study outlined in this protocol seeks literature in multiple disciplinary areas, and so it is anticipated that the numbers will be closer to the former of these two examples.

#### C. Information Sources

Candidate items will be sought in academic databases in the fields of higher education, business, organizational psychology, and sociology. Part of the goal of the scoping review is to explore the conceptual links between notions of teamwork in educational and professional contexts. To this end, the following databases were selected to form the basis of the initial data pool: Scopus, Web of Science, ERIC, and PsycInfo. Scopus and Web of

Science were chosen as comprehensive multi-disciplinary databases. Web of Science provides coverage of the top 20 journals listed by Google Scholar in the category of 'Human Resources and Organizations'. Scopus and Web of Science were supplemented with ERIC, chosen for its specialization in education literature, and PsycInfo, which was chosen to provide literature in subfields of psychology related to teamwork and organizational management. This combination of multidisciplinary and domain-specific databases follows a pattern suggested by the library of the University of South Australia<sup>2</sup>.

#### D. Search Terms

Developing search terms is an iterative, multi-stage process, driven in part by pragmatic considerations. The search terms are modified and retried in response to the quantity and apparent relevance of the results. This iterative characteristic of the process is acknowledged in a number of methodological sources, (e.g. [1][9][10]). What follows is an account of an exemplary search process undertaken to explore and understand the procedures involved, and may not be reproduced exactly in the finalized review. The reporting of the review will be written in dialogue with this account to preserve any changes and the reasoning for them.

Following advice from University of Michigan library staff, the process begins with two independent searches in the Scopus database, the first using the search term "team\*" (the asterisk allowing for morphological variants such as 'teamwork'), and the second using "equit\* OR effective\* OR success\*". At this stage the searches are run to refine the search strings, rather than to recover the search results themselves.

In both cases, successive steps are undertaken to refine the results. The 'Keywords' filtering functionality is used to elaborate the search terms, followed by filtering by timeframe/year (limit to January 2017 to December 2021), subject area (limit to sociology, psychology, engineering, business, multidisciplinary), publication type (limit to journal articles, conference proceedings, book chapters), and language (limit to English<sup>3</sup>). When the filtering processes are complete, the resulting search strings are saved. Scopus then allows the two searches to be combined into a single search that returns only results matching both search one and search two. As discussed above, the iterative nature of the process as outlined in the methodological guidance means that the steps detailed here are not conclusive; indeed, as of writing, this strategy returns 3,733 results, too high a volume for the screening steps. Further iterative refinement will be necessary and the details of refinement this will be recorded in subsequent reporting.

<sup>2</sup> <https://guides.library.unisa.edu.au/ScopingReviews/WhereToSearch>

<sup>3</sup> [1] recommends that "authors do not apply language restrictions to their protocols unless there is reasonable justification, such as feasibility or limitation of resources". Conducting a scoping review in multiple languages would seem extremely resource-intensive, and create problems with regard to

inter-rater reliability. This is not elaborated upon in [1], and the authors of the present study chose to limit the search to English due to resource constraints. This will be acknowledged in the limitations section of reporting outcomes.

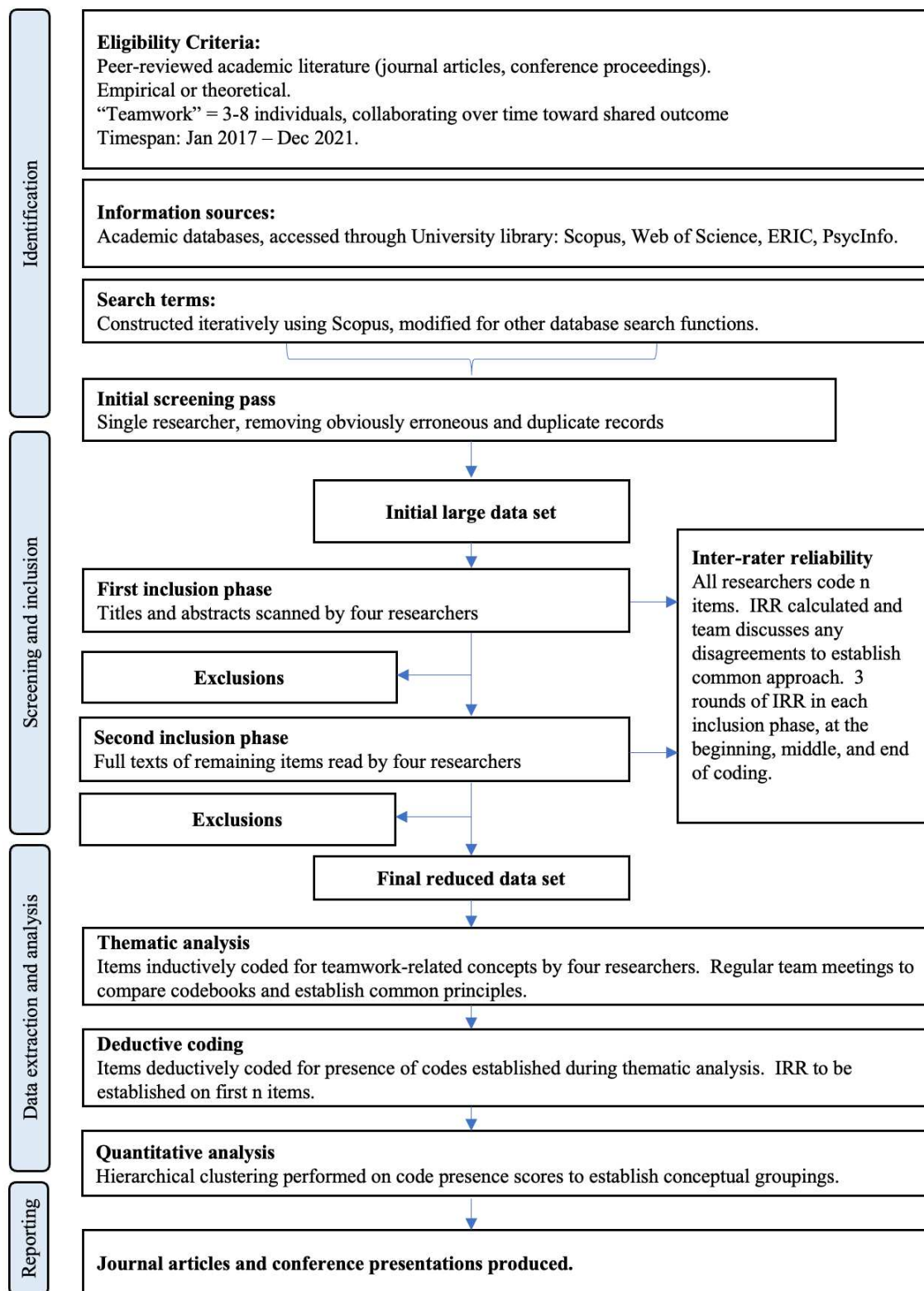


Fig. 1. Flow diagram of scoping review protocol

Following this dynamic process of search term construction within Scopus, the resulting strings will be rewritten in more generic terms to be used in the other three databases. Results from all databases will be downloaded with titles and abstracts as a csv file for processing and coding.

#### IV. SCREENING THE RESULTS

When the search strategy has produced a satisfactory set of items, the process of manually reducing the size of the sample begins, through the application of the eligibility criteria described above. This is undertaken in two main phases, with the potential for a third pass if necessary.

##### A. First Inclusion Phase

In this phase, titles and abstracts of articles are scanned with a brevity necessitated by the large amount of data. An initial pass will be made by a single research team member to discard obviously irrelevant items, with a brief account of this process being subsequently presented to the rest of the research team. All remaining items will be then divided equally among four researchers to be coded for include/exclude with a brief explanatory justification, and there will be three rounds of interrater reliability (IRR) testing. The first round takes place at the beginning of the process, with all researchers coding a randomly-selected set of 100 items (25 from each share—these numbers may change depending on the size of the search results set). As well as formally calculating IRR at this stage (using Cohen's kappa), the research team will engage in reflective discussions to promote consensus regarding how strictly to apply the eligibility criteria at this stage, and whether and to what extent to give items the 'benefit of the doubt' in cases where paucity of information in title and abstract make decision-making difficult. At a pre-set time period designed to represent a halfway point in the coding process, the second round of IRR testing takes place, with each researcher contributing 25 random-chosen items that they have recently coded to be coded by the other three researchers. A third round of IRR testing takes place after all the items have been coded, and repeats the procedure of the second round. This model of rigorous IRR is taken from [13].

##### B. Second Inclusion Phase

In the second phase, the full texts of items coded for inclusion in the first phase are skim-read for a second round of inclusion/exclusion coding, to further reduce the data set to a manageable number of items for detailed analysis. The three-stage IRR process will again be followed, as well as regular meetings of the research team to ensure consistency in the application of the eligibility criteria, in response to the evolving dimensions of the final data set.

#### V. DATA EXTRACTION AND ANALYSIS

Methodological guidelines do not specify a minimum or maximum number of items to be included in the final data set to ensure validity or robustness, with this judgment characterized as a trade-off between comprehensiveness and feasibility [11]. Extant cases of protocols published prior to the study taking place (e.g. [2][3]) make no commitment to the intended size of the data set. Sample sizes in previous scoping reviews include  $n=10$  [13],  $n=23$  [15], and  $n=37$  [12]. This number will not

therefore be specified concretely *a priori*, although it is anticipated that adequate coverage of concepts in two or more areas (i.e., equitable teamwork, effective teamwork, successful team outcomes), will require a data set at or above the upper end of the range shown above, perhaps around 40 items.

Items will be coded inductively following the research questions. Conceptualizations of team success, team effectiveness, or team equity will be identified and their constituent components coded. As these are intended to be emergent concepts, coders will maintain a codebook with brief explanatory descriptions of codes. Coders will convene weekly to compare codebooks, identify overlapping concepts and standardize codes as much as possible. Similarly to the inclusion coding, three rounds of interrater reliability testing will be undertaken, at the beginning, middle, and end of the coding process.

When a complete codebook has been derived from the dataset and standardized between researchers in the manner described above, the codebook will be used as an observational grid for each document (c.f. [13]). All documents will be revisited and the presence of all codes rated on a scale of 1-3, with 1 indicating that the code is not present or negligibly present, 2 indicating that it is partially or peripherally present, and 3 indicating that it is explicitly and centrally present. These scores will then be subject to a clustering analysis to identify common conceptual groupings.

#### VI. ANTICIPATED OUTCOMES

The scoping review outlined in this protocol is intended to produce a theoretical framework or conceptual typology, locating and relating different indicators of team success—whether measured through task completion, team member development, interactional outcomes or some other aspect of the team process. The resulting framework will incorporate differing priorities in different contexts, accounting for distinctions between pedagogically-motivated team interactions and those with a productivity focus. It will further frame the constituent components of different conceptualizations of team success, and provide an understanding of how notions of equitable teamwork connect with, and support, effective teamwork.

#### VII. REPORTING AND CONTRIBUTIONS

The review will result in a journal article or articles that will discuss and analyze the various conceptualizations arising from the study. This outcome will contribute to the fields of engineering education, education more broadly, and teamwork studies, by presenting a theoretical integration of equity and effectiveness under a broader umbrella of team success. Reporting outcomes will also provide further, retrospective methodological detail of the scoping review process, especially the realization of iterative processes, as well as details of IRR. Additionally, in comprehensively and rigorously documenting the scoping review process, the resulting articles, in combination with this protocol paper, will contribute to the continuing evolution of the scoping review methodology.

## VIII. CONCLUSION

The review outlined in this paper is intended to expand the scope of discussion regarding what it means for team-based, project-based work to be considered successful, and what alternatives exist to task completion as measures of success. In setting out a detailed methodological protocol, this paper has laid the foundation for a rigorous, representative, and replicable literature review. Subsequent outputs will enact a dialogue with this foundational paper, enabling a methodological account that will explicitly discuss actualized processes with reference to *a priori* intentions. As a method, scoping reviews have great value in framing and representing a field, but must be conducted with a high level of transparency for this to be effective. It is our belief that this paper makes a valuable contribution to the development of such transparency.

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