Advances in Health Sciences Education (2020) 25:383–399
https://doi.org/10.1007/s10459-019-09931-3

Role of team dynamics in the learning process: a mixed-methods evaluation of a modified team-based learning approach in a behavioral research methods course

Elizabeth Reisinger Walker[1] · Delia L. Lang[1] · Bethany A. Caruso[2] · Leslie Salas-Hernández[1]

Received: 1 March 2019 / Accepted: 14 October 2019 / Published online: 18 October 2019

Abstract
Health sciences education is increasingly focusing on building students' skills to work collaboratively. Therefore, instructors must intentionally incorporate team-based skill building into their courses, using teaching strategies like team-based learning (TBL). An assumption of TBL is that team dynamics facilitate learning; however, limited research has examined this connection. The primary purposes of this mixed-methods evaluation were: (a) to describe the characteristics of team dynamics in a graduate-level research methods course that employs a modified TBL approach, and (b) to examine the association between team dynamics and student grades. Given the importance of preparing health professional students to work collaboratively in their careers, a secondary aim was to examine how team skills developed through a team-based learning approach could be transferred to other courses and to future jobs. We conducted surveys on team dynamics at mid-semester (n = 64) and the end of the semester (n = 66), collected students' grades for the final paper and overall course, and conducted 4 focus groups with Master of Public Health students (n = 25). Paired *t* tests were used to examine change in team dynamics and correlations were conducted to assess the relationship between team dynamics and grades. Thematic analysis was used to identify themes related to team dynamics from the focus group data. Overall, students reported experiencing positive and beneficial team dynamics. The findings support two main underlying categories of team dynamics, interpersonal team processes and task orientation, and the linkages between the categories that allow teams to function. Team dynamics scores were not associated with student grades. However, students recognized the value of practicing team skills in preparation for future group work and jobs. These findings suggest that active learning approaches, such as TBL, can help to facilitate the acquisition of collaborative skills.

Keywords Collaborative learning · Health sciences education · Mixed-methods · Public health · Team-based learning · Team dynamics

✉ Elizabeth Reisinger Walker
ereisin@emory.edu

Extended author information available on the last page of the article

Introduction

In recognition of the interdisciplinary nature of the work that health sciences graduate students take on after graduation, curricula across fields is increasingly focusing on collaboration and building students' skills in working in teams (Buhse and Ratta 2017; Frenk et al. 2010; Thibault 2015). Multiple professional organizations and accrediting bodies for professional degree programs have put forth recommendations and developed competencies that underscore the importance of preparing students to work on teams within and across disciplines. These recommendations span the health sciences fields, including medicine, nursing, and public health (Association of the Schools and Programs of Public Health 2014; Council on Education for Public Health 2016; Commission on Collegiate Nursing Accreditation 2018; Interprofessional Education Collaborative 2016). The competencies underscore the need for students entering the workforce to be able to effectively communicate, value diverse perspectives, and collaborate with a variety of professionals (Interprofessional Education Collaborative 2016).

In order to meet competencies related to team work, there is a need for instructors in health sciences programs to intentionally incorporate team-based skill building into their courses. Team-based learning (TBL) is one teaching strategy that supports the development of both content knowledge and effective interpersonal and teamwork skills. TBL was developed by Michaelsen et al. (2004) to promote critical thinking, collaborative learning, and active engagement. Research on TBL covers several different fields, including health and social sciences (Fatmi et al. 2013; Haidet et al. 2014; Kalaian and Kasim 2017; Lang et al. 2018; Reimschisel et al. 2017; Sisk 2011). The findings from several reviews indicate the effectiveness of TBL in increasing student performance and engagement in course content (Fatmi et al 2013; Haidet et al. 2014; Kalaian and Kasim 2017; Reimschisel et al. 2017; Sisk 2011). Haidet et al. (2014) noted that two studies in their review followed learners into the workforce. While neither study employed a rigorous design to compare TBL with other educational formats, the results suggested that learners were able to effectively implement the team skills they acquired in their roles as nurses and psychiatric residents. In one study, nurses who completed a TBL-based training (n = 23) on procedures for triage nurse initiated X-rays were more likely than nurses who did not take the training (n = 17) to appropriately request X-rays and complete patient documentation (Considine et al. 2013). In the other study, faculty supervisors reported that psychiatric residents who completed a psychotherapy didactic course using TBL were able to more effectively incorporate the concepts into their treatment delivery compared to residents who previously took the course in a different format (Touchet and Coon 2005).

An assumption of TBL is that team dynamics and cohesion facilitate both team-based learning and individual student learning (Michaelsen et al. 2004). Team dynamics encompass the interactions and processes within groups that allow the group to function and complete tasks (Chapman et al. 2006; Schulz et al. 2003). Team dynamics are multifaceted and include decision making, problem-solving, and conflict resolution processes; communication strategies and comfort in expressing opinions; leadership and influence, trust between team members, commitment, and participation (Schulz et al. 2003). Group cohesion is a related construct that comprises the shared bond between team members and their commitment to complete tasks (Salas et al. 2015; Carless and De Paola 2000).

The assumption that team dynamics can contribute to learning fits within the broader social constructivist learning theory that underpins TBL and other small group, active learning approaches (Hrynchak and Batty 2012; Kalaian and Kasim 2017). Social

constructivism, as described by Vygotsky (1980), posits that learning is an interdependent process. The strategies that individuals develop to learn and integrate knowledge come out of interactions with other people (Palincsar 1998; Vygotsky 1980). Social constructivist learning theory contains four main elements, all of which are addressed in TBL: (1) the instructor guides students and facilitates learning, rather than being the main provider of knowledge; (2) problem-solving allows students to integrate new knowledge and challenge previously held conceptions; (3) learning occurs through problem-solving and interactions with other students; and (4) reflection on new experiences and learning is important (Hrynchak and Batty 2012). Team dynamics, in particular, falls under the third element related to students learning by engaging with each other and the material. Students construct knowledge and skills by working together, sharing the knowledge and perceptions each person brings to the team, and iteratively integrating new ideas (Hrynchak and Batty 2012; Kalaian and Kasim 2017; Peters 2000). Therefore, teams that interact and function well may be more efficient at reaching the point where learning can effectively occur in the group setting.

While the connection between team dynamics and learning is theoretically supported, few studies have described team dynamics or cohesion in TBL classrooms and examined their association with student learning. Evaluations of TBL in health sciences classrooms demonstrate by the end of the semester, students report more positive attitudes toward working in teams (Huitt et al. 2015; Vasan et al. 2009) and stronger skills in collaboration (Davidson 2011). In a study of 317 medical students in an anatomy course, Vasan et al. (2009) found that students' perceptions of teamwork were not related to their grade in the course. In a study of 975 medical students completing a psychiatry rotation, results showed that greater team cohesion predicted higher team exam scores (Thompson et al. 2015). In addition to these sparse findings, to our knowledge, there is little examination of the underlying processes that facilitate the development of team dynamics and functioning.

Given the focus on developing health sciences students' skills for working in teams, we sought to build upon the limited research on team dynamics related to graduate student academic performance. In particular, we were interested in exploring the facets and processes of team dynamics that supported or hindered student learning. The main purposes of this mixed-methods evaluation were: (a) to describe the characteristics of team dynamics in a graduate-level research methods course that employs a modified TBL approach, and (b) to examine the association between team dynamics and student performance in the course. Given the importance of preparing health sciences students to work collaboratively in their programs and once they graduate, a secondary aim was to examine how team skills developed through a team-based learning approach could be transferred to other courses and to future jobs.

Methods

Course design

We evaluated team dynamics in a behavioral research methods course that is required for all Master of Public Health (MPH) students in the Department of Behavioral Sciences and Health Education at Emory University's Rollins School of Public Health. Students take this course in the first semester of their 2-year program. In the fall of 2016, two sections of the course were offered, with 48 students in one section and 49 in the other. The instructors of both sections (ERW and DLL) followed the same course schedule and syllabus.

We implemented a modified TBL approach throughout the semester, which had first been implemented the previous year (for more detail, see Lang et al. 2018). The course included 14 weekly class sessions, each for 2 h and 50 min. Prior to the first class, students completed a brief survey to indicate their previous experience with research and research methods. Then, the instructors assigned students into teams based on their level of previous experience; the goal was for each team to have diversity in experiences. The process of team formation was explained to the students during the first class session.

The first class session involved an introduction to the course, grouping students into their teams, and completion of a communication styles inventory. Subsequently, teams discussed their preferred communication styles and developed team rules to guide their collaboration throughout the semester. Eleven class sessions covered research methods content, such as study designs, sampling, and measurement. These sessions followed a modified TBL approach, which is described below. The remaining two sessions, one at mid-semester and one at the end of the semester, depart in format from the TBL approach. These two sessions were both devoted to team discussions of how the team worked together and peer review of their individual final paper drafts.

For the 11 class sessions that covered research methods content, students were expected to complete assigned readings prior to class. At the beginning of class, teams had 20 min to complete the team Readiness Assessment Test (tRAT), a 5 question, closed-book, multiple-choice quiz drawing from the assigned readings. Using the Immediate Feedback Assessment Technique, teams were provided with a scratch-off form that allowed students to receive real-time feedback on their quiz answer choices (Michaelsen and Sweet 2008). Based on our evaluation of implementing TBL the previous year and student feedback, modifications to the traditional TBL format included dropping the individual Readiness Assessment Test and the appeals process. More detail about the process for making these changes is available in our previous publication (Lang et al. 2018).

Following the tRAT, the instructor answered any questions about the quiz and then delivered a short lecture of approximately 20 min. For the majority of class time, students worked together in their teams on the team assignment, which required them to critically consider the content covered in class, apply the material to a scenario or problem significant to health promotion, and synthesize and justify their decisions and conclusions. All teams worked on the same assignment. During the last 20 min of class, teams simultaneously reported their main finding or conclusion from the team assignment, usually by posting brief answers on the board. The instructors facilitated a class discussion about similarities and differences across the team responses.

Students' grades in the course were based on assessments of individual performance (50%) and team performance (50%). The individual performance criteria included submitting a completion report for an ethics certification program (5%), an assignment in which students developed a research question for their final paper (5%), a review of a peer's paper draft (10%), their final research proposal paper (25%), and a self-reflection essay (5%). The team performance component of the grade included average tRAT scores, with the two lowest scores dropped (20%); the average team assignments scores, with the two lowest scores dropped (25%); and the mid-semester and end of semester peer evaluations (5%). For the peer evaluations, students rated each teammates and themselves out of 10 points. Students wrote a justification of their rating, based on their teammates' preparation, contribution, respect for others' ideas, and flexibility. This procedure differs from the traditional TBL approach of dividing 100 points among teammates (Michaelsen et al. 2004).

Team dynamics evaluation

Three data sources were used in this mixed-methods evaluation of team dynamics: (1) student surveys completed at mid-semester and the end of the semester, (2) students' grades for the final individual paper assignment and the overall course, and (3) focus groups with first- and second-year MPH students. A postdoctoral fellow with no prior involvement in the course served as an external evaluator for this project. The evaluator and a second year MPH research assistant (RA) managed the data collection process. Emory University's Institutional Review Board approved all study procedures.

During the first class of the behavioral research methods course, for both sections, the evaluator described the different parts of the study. She reviewed the consent form for student grades and obtained written consent from students who wished to allow their grades to be included in the study. She also explained that students would receive emails about the surveys and focus groups at a later time, each of which included separate consent procedures.

Student surveys

The student surveys were administered online through SurveyMonkey. The evaluator emailed survey links to all first-year MPH students enrolled in the behavioral research methods course at mid-semester and at the end of the semester. The evaluator sent reminder emails to all students within 1 week of the initial email. About 2–3 weeks later, the evaluator sent targeted emails to individuals who had yet to respond. For each survey, the students provided informed consent online before proceeding to the survey questions. The survey took approximately 10 min to complete. Participants entered their student identification number so that the mid- and end of semester surveys could be linked. After the RA linked the surveys, the student ID number was replaced by a unique identifier in order to deidentify the data.

The survey included the Team Dynamics Scale, demographic questions, and questions that assessed perceived effectiveness of TBL components and perceived mastery of learning outcomes. For this analysis, we focused on the Team Dynamics Scale, which we adapted from an instrument that defined team dynamics as "interactions among the students and the processes within their groups" (Chapman et al. 2006, p. 562). The scale included 12 items ranked on a 7-point Likert scale from (1) *strongly disagree* to (7) *strongly agree*. Participants were instructed to rate "To what degree do you agree or disagree that you and your teammates…" for each of the items, such as "resolve conflict effectively" and "follow through on commitments." Two items were reverse coded: "could work better together" and "argue quite a bit." The item scores were summed, with higher scores indicating more positive team dynamics. The Team Dynamics Scale showed good reliability with a Cronbach's alpha of .87 and .84 at mid- and end of semester, respectively. For analysis, we summed the participants' item scores then took the average for ease of comparison to the original Likert-scale response options.

Student grades

During the consenting process on the first day of class, students indicated which grades they consented to have included in the study: final paper grades and/or final course grades.

The evaluator collected and securely stored the consent forms in a sealed envelope until after course grades were submitted so that the instructors were not aware of who provided consent to participate. After final grades were submitted at the end of the semester, the RA downloaded the grades of students who provided consent from the course management systems (n = 76 for the final paper grade; n = 75 for the final course grade). The grades were linked to the students' unique identifier and identifying information was deleted.

Focus groups

Four focus groups were conducted between January and February 2017: two with first-year MPH students who had recently completed the behavioral research methods course, and two with second-year MPH students who took the course in the fall of 2015. We chose focus groups for data collection because team dynamics is a group-based process. Focus groups allowed for the discussion of a variety of experiences and perspectives between participants, enabling them to recognize, reflect, and comment on experiences which were unique to their team or common between teams. To recruit participants, the evaluator emailed all first and second year students by cohort. Focus groups took place in a room at the University and lasted about 75 min. All participants provided informed consent at the beginning of the focus groups; they consented to participate verbally and were not required to sign their name in order to maintain anonymity. Participants also completed a three question demographics questionnaire (gender, race/ethnicity, and age).

The external evaluator moderated all focus groups and the RA took notes. The evaluator used a semi-structured guide that included the following topics: ways in which the teams worked well or did not work well together, challenges the teams encountered, and how the teams contributed to the student's learning. Second-year students were also asked about groupwork experiences in other courses and how students' experiences with their TBL teams informed their approach to teamwork in other courses.

Data analysis

Student survey and grades

The survey data was downloaded from SurveyMonkey into Excel and course grades were downloaded from the course management systems. All linked and de-identified data were uploaded into SPSS for analysis. Descriptive statistics of demographics and the Team Dynamics Scale were run (mean and standard deviation). The psychometric properties of the Team Dynamics Scale were assessed through reliability statistics and principal components factor analysis, with factor rotation using the Varimax procedure. Paired *t* tests were used to examine change in team dynamics from mid-semester to the end of the semester. Pearson correlations were conducted between team dynamics, students' final paper grade, and students' final course grades. Independent *t* tests and analysis of variance (ANOVA) tests were used to examine any differences in team dynamics or grades by instructor.

Focus groups

Focus group discussions were digitally recorded and transcribed verbatim. The RA reviewed the transcripts for accuracy and to remove identifying information. Transcripts were uploaded into MaxQDA for data management and analysis (Version 12, VERBI

Software, Berlin, Germany). Focus group data were analyzed using thematic analysis, which is a flexible method for identifying, analyzing, and describing patterns, or themes, within the data (Braun and Clarke 2006). A codebook was developed deductively, based on the focus group guides and items in the team dynamics scale (e.g., communication, task oriented). As we reviewed the transcripts, additional codes were inductively added based on other relevant topics in the qualitative data (e.g., contributions, changes in dynamics). Two researchers (ERW and LS-H) independently coded the focus group transcripts, discussed coding, and addressed any discrepancies. Throughout the process, the researchers wrote memos on key codes, particularly those capturing elements of team dynamics, and relationships between the codes (Braun and Clarke 2006). We also wrote memos to examine students' experiences in other group work settings and how students transferred their team skills to other courses.

During the qualitative analysis, we considered the existing literature on team dynamics and the two main factors from the Team Dynamics scale: interpersonal and task processes (Carless and De Paola 2000; Tuckman 1965). We wrote memos exploring how coded segments under each main code related to team dynamics (e.g. communication, conflicts/challenges, comfort, contributions, task delegation, and others) aligned with the categories of interpersonal relationships and task processes. We also wrote about the emerging theme of the linkages between the two categories for each code.

Triangulation

In conceptualizing team dynamics, the qualitative and quantitative findings were considered together. The quantitative findings indicated two main factors of team dynamics. The qualitative findings were used to provide a more in-depth description of the factors from the Team Dynamics Scale and to describe aspects of team dynamics that were not captured in the scale.

Reflexivity

Two of the authors (ERW and DLL) were instructors of course; therefore, we continually examined our expectations about the role of teamwork and the TBL structures in student learning. We waited to examine the data until it was completely de-identified so that our views of any particular student or awareness of their performance in the course would not influence our analysis of the data. At the time of the study, LS-H was a second year MPH student, who had taken this course the previous year. Her role as a student provided a valuable perspective, which needed to be balanced by an awareness of how her own experiences may influence her views of the data. At the time of the study, BAC was a postdoctoral fellow with an interest in teaching, but no connection with the course, and thus well-positioned to lead student recruitment for surveys and FGDs and to also lead FGDs.

Results

Participant characteristics

Of the 97 students enrolled in both sections of the behavioral research methods course, 64 (66%) completed the mid-semester survey and 66 (68%) completed the end of semester

survey. A total of 45 students (46%) took the survey at both time points. For both surveys, almost 90% of respondents were women, just over 40% identified as minority, and respondents had a mean age around 24 years (Table 1). The sample demographics are similar to the student body in our department (i.e. 90% women, 41% minority). Of the 97 enrolled students, 76 (78%) and 75 (77%) consented to release their final paper grade and final course grade, respectively. The mean final paper grades were 92.2% (SD = 5.74) and mean final course grades were 95.9% (SD = 1.93). Final paper grades did not differ by instructor, $t(61) = -1.93$, $p = .06$. Mean final course grades were significantly different between sections, $t(61) = -2.14$, $p = .04$; however, the magnitude of the difference was only one percentage point (Section 1: $M = 96.53$, $SD = 2.05$; Section 2: $M = 95.56$, $SD = 1.52$).

The majority of focus group participants were women (78.6% of first year students and 90.9% of second year students) with a mean age around 26 years old. Among first and second year students, 21.4% and 36.6% identified as minority, respectively.

Team dynamics scale factor structure

Principal components exploratory factor analysis of the scale resulted in 3 factors with an Eigenvalue greater than 1.0. Items loaded primarily on two main factors, which, informed by the literature, we termed: Interpersonal Team Processes (7 items, including communicate well with each other and comfortable asking other members for help) and Task Orientation (3 items, including go straight to work in class and task oriented during class time). The item "follow through on commitments" loaded onto both Interpersonal Team Processes and Task Orientation, with a higher loading on Task Orientation at mid-semester and a higher loading on Interpersonal Team Processes at the end of semester. The third emerging factor, which we termed Team Dysfunction, included 2 items ("achieve harmony

Table 1 Demographics of survey and focus group participants

	Mid-semester survey (n = 64), % (n)	End of semester survey (n = 60), % (n)	Focus groups (n = 25), % (n)
Gender			
Female	89.1 (57)	88.1 (52)	84 (21)
Male	10.9 (7)	10.2 (6)	16 (4)
Other	–	1.7 (1)	–
Race/ethnicity			
Asian/Pacific Islander	14.3 (9)	8.3 (5)	24 (6)
Black/African American	23.8 (15)	28.3 (17)	8 (2)
Hispanic	3.2 (2)	5.0 (3)	–
White/Caucasian	57.1 (36)	58.6 (35)	60 (15)
Multiracial/Multiethnic	1.6 (1)	–	8 (2)
Age, *M* (SD), years	23.8 (1.93)	24.8 (4.31)	25.9 (5.61)
Year in program			
First year	100 (64)	100 (60)	56 (14)
Second year	–	–	44 (11)
Paper grade (n = 76)		92.2 (5.74)	
Final course grade (n = 75)		95.9 (1.93)	

by avoiding conflict" and "argue quite a bit") at the middle of the semester. However, at the end of the semester, only one item ("argue quite a bit") loaded consistently on this factor. Given that Team Dysfunction had only one stable item, we focused on the other two main factors for the remainder of the analysis.

Differences in team dynamics by time and course section

While individuals rated the dynamics of their team highly at both mid-semester ($M = 5.68$, $SD = .81$ on a 1–7 scale) and end of the semester ($M = 5.96$, $SD = .79$), significantly higher team dynamics scores were observed at the latter timepoint, $t(44) = -2.49$, $p = .02$. Mean team dynamics scores significantly differed between sections at mid-semester (Section 1: $M = 5.43$, $SD = .74$; Section 2: $M = 5.82$, $SD = .76$; $t(62) = 2.11$, $p = .04$), but not at the end of the semester (Section 1: $M = 5.93$, $SD = .77$; Section 2: $M = 5.97$, $SD = .79$; $t(58) = .20$, $p = .84$). A two-way ANOVA indicated that the change in team dynamics scores across the two time points did not differ by section, $F(1,43) = 3.55$, $p = .07$.

Team dynamics scores at either time point were not associated with final paper grades [Mid-semester: $r(63) = -.18$, $p = .16$; End of semester: $r(58) = -.12$, $p = .37$)] or final course grades [Mid-semester: $r(63) = -.11$, $p = .38$; End of semester: $r(57) = .06$, $p = .65$]..

Conceptualization of team dynamics

Mixed-methods results from the four focus groups, the exploratory factor analysis of the Team Dynamics scale, and existing literature support the conceptualization of team dynamics into two related categories (see Table 2). Both categories, Interpersonal Team Processes and Task Orientation, align with factors of the Team Dynamics scale and have strong support from the qualitative themes. Specifically, Interpersonal Team Processes includes interactions between team members that allow for the team to function effectively, while Task Orientation involves the process of completing required tasks and assignments as a team. Linkages between Interpersonal Processes and Task Orientation, shown in the middle column of Table 2, emerged from focus group data. The aspects of team dynamics in this category highlight ways in which general interpersonal team processes are applied toward effective completion of tasks within the specific context of this course.

Interpersonal team processes

Interpersonal team processes include elements of communication, managing personalities and work styles, comfort level, conflict resolution, and the degree to which interacting with the team was enjoyable. Focus group participants described learning to communicate about how the team was functioning and how to speak to each other in a professional manner. One student mentioned the importance of "…knowing how to speak to someone in a way that they resonate with, and that's not the same for each person, and I think each person in our group understood what that language was for the other person…" Students discussed the process of learning to manage three specific aspects of working as a team: (1) different personalities, particularly the balance between teammates who were more introverted or extroverted; (2) different motivations for what they wanted to get out of class, such as wanting to get high grades, wanting to learn the material, or just wanting to get the assignments done; and (3) different work styles. A student noted the challenges of working through these processes in this quote,

Table 2 Main categories of team dynamics identified from the mixed-methods evaluation

Category 1: interpersonal team processes	Linkages between interpersonal processes and task orientation	Category 2: task orientation
Learning how to communicate as a team, how to speak to each other professionally	Communication about reading and preparation	Coming to class prepared and ready to participate
Managing different personalities, motivations, and work styles	Discussion and teaching each other about research methods content	Getting right to work in class
Becoming comfortable with being honest with teammates, providing constructive critique about how the team was working	Addressing distribution of work	Task delegation and development of approaches to complete assignments
Resolving conflict	Figuring out different ways in which people work so that everyone can contribute	Degree of focus on tasks when in class
Enjoying working together	Becoming comfortable admitting when they did not understand a concept	
	Becoming comfortable admitting when they were not prepared	
	Development of trust in teammates' abilities to complete quality work	
	Feeling accountable to the team	

> This is very challenging to work with five other people, all different backgrounds, different knowledge levels, different experience levels in research or work, and approaches to problem solving… Finding out how to tackle a problem with five other people was absolutely difficult, but I think it pushed me to problem solve and to really listen to other people more than I thought I was doing prior.

Related to managing differences among teammates, students also talked about becoming comfortable enough with their teammates to honestly discuss how the team was functioning and provide constructive feedback to each other.

Task orientation

Task orientation involves pre-class preparation and a focus on completing the work when in class. Focus group participants discussed the importance of each student coming to class prepared and ready to contribute to the team's work that week. As one student noted about pre-class preparation:

> … there was also pressure to fully comprehend what you were reading, because you were going to have to verbalize what you were saying and defend it to the team, and then in addition, if you didn't read or comprehend the reading, the team could tell that you weren't contributing.

Task orientation also involved getting right to work and remaining focused on the quiz and team assignment. The focus group participants noted that their teams mostly stayed on task during class in order to be able to complete the team assignment during the allotted class time. A few participants mentioned that their team had in-depth discussions about the material, but then needed to focus on actually completing the assignment. Other teams would sometimes get sidetracked on unrelated conversations.

Another important element of task orientation was the process of delegating tasks among the group and developing approaches for completing the assignments, which varied from team to team. Several teams fell into defined roles of which teammates summarized the content, wrote up the ideas for the assignment, and edited the final work before submission. Other groups discussed the entire assignment first before writing it up together. One student discussed their team's approach, "We worked very well going quickly and doing like a quick brainstorm, and then like doing a quick vote on what we were actually going to do and dive in and work together."

Linkages between interpersonal processes to task orientation

A major theme that emerged from the focus groups was the ways in which interpersonal elements, such as communication, comfort, and conflict resolution, were applied to task orientation and completion. Students' discussions in the focus groups demonstrated that interpersonal processes and task orientation interacted, contributing to the overall functioning of the team in the course.

Linkages between the interpersonal processes and task orientation categories for communication involved teammates updating each other outside of class about their pre-class preparation and teaching or clarifying research methods concepts to each other. Students also described the process of teammates becoming comfortable enough with each other to admit when they did not understand a concept or when they were not prepared for class. This process differed across teams. Some groups developed "direct lines of

communication" from the beginning and quickly felt comfortable admitting when they did not know something. Other groups took a while to establish that comfort and level of communication. One student noted,

> For us it took a little while for people to be comfortable saying that they just don't understand something…and I think that was one of the more important things that I learned was that it's okay to be honest about if you're not understanding something or be honest about what you're capable of doing.

Students also discussed the process of figuring out the different ways in which people work, so that everyone could contribute to the quiz or team assignment. For example, students who were introverted or who work or read at a slower pace might be seen at first as not contributing very much. One student described,

> I feel like I'm definitely like a quieter person too, so at the beginning I feel like a challenge for me and probably one other member of our group was just kind of speaking up a little bit more and making sure that our perspectives were brought into the conversation, but the more like extroverted like social members of our group, like—just did a really good job of making that an environment where we felt comfortable speaking up, so I feel like as the semester progressed, that kind of became less of a challenge for the quieter people in our group.

Some students described tension when there was an uneven distribution of work, when some team members were not pulling their weight or coming prepared, or if some people in the group were more controlling of the conversation. Working through these challenges involved being able to talk honestly within the group, listen, and compromise. Over time, teams developed trust in each other regarding the quality of their work. One student said,

> …we started splitting up tasks more and trusting each other a little bit more…I feel like that's kind of my ideal situation, especially outside of a classroom setting, like if you're working on a team like at the CDC [Centers for Disease Control and Prevention], of course you're going to want to work together, but you're going to have to rely on other people to do their own thing without having like everyone's spoons in the pot.

Transferability of team skills to other situations

Another salient theme from the focus groups was the transferability of the team skills students practiced in the research methods course to other situations. Students stated that working in TBL teams set the foundation for group work in subsequent courses and prepared them for the workforce once they graduate. Second year students noted that team skills were helpful in other classes, particularly community-engaged learning (CEL) classes that involved accountability to a community organization. Students applied what they learned about their personal working style and how to work with others to other group projects. One second year MPH student said that, "…learning how to work in a group is… probably the most important thing I've learned [in graduate school]." The second year students felt that learning to manage disagreements, compromise, and learn from peers was valuable preparation for the workforce.

Students noted that the intentional fostering of teams and team dynamics through TBL differed from other classes that used informal group work in class or included a group project that was mostly completed outside of class. They suggested that instructors could

incorporate aspects of TBL in other classes in order to better support accountability, communication, and decision-making. One student said,

> I think there are really easy little tweaks that could be in [CEL classes] to incorporate some of the models that we use there, because I think it sounds like we all had like a really good experience in our methods [TBL] group, and then once things changed because it was– you have to meet out of class, and you only have 10 min during class to talk to each other or things like that where it wasn't structured, that's when things became messier and more confusing.

Students felt that the experience of having TBL in their first semester was a helpful foundation for other group work, which could be built upon throughout the curriculum.

Discussion

Our study provides an in-depth look at facets of team dynamics in graduate student groups that extends previous literature. Overall, findings from this mixed-methods study suggest that students experienced positive and beneficial team dynamics. Evidence from both the quantitative survey and focus groups supports two main underlying factors of team dynamics: interpersonal team processes and task orientation. Interpersonal team processes include communicating with team members, managing different personalities and working styles, and developing trust and commitment to the team. Task orientation was described as coming to class prepared, both in terms of having completed the assigned readings and also being ready to actively participate, being focused on the tasks at hand and delegating tasks among team members. Additionally, an emerging theme from the focus group data that provides new insight into team dynamics focused on the linkages between interpersonal team processes and task orientation that allow teams to function well within the course. Notably, however, team dynamics was not associated with students' performance on the final paper or in the course.

Team dynamics and cohesion are foundational for team functioning and effectiveness (Chang and Bordia 2001). In addition to aligning with previous research on the components of team dynamics (Chapman et al. 2006; Schulz et al. 2003), our findings further describe the multifaceted and fluid nature of team dynamics within student groups. Our results extend the literature on team dynamics by describing the interconnections between interpersonal processes and a focus on completing tasks. Themes from the focus groups suggest that team dynamics evolved and were refined throughout the semester as interdependence grew and individual students began to view themselves as part of the team and to feel accountable to the team. Trusting that other team members are committed to shared goals and contribute to the team's success may follow a period of assessing other team members' personalities, working style, and motivations for engaging in the course. While for some teams the process of coming together as an interdependent, cohesive team occurred rapidly, other teams took longer. However, in general, teams were able to develop channels of communication that allowed them to disclose to each other when they were unprepared for class or when they did not understand course content. Often, this level of comfort allowed for team discussions about content and process and even resulted in teaching each other about difficult conceptual content. Additionally, students were able to utilize communication skills to address distribution of work among team members, provide constructive critique, and resolve conflict. Thinking about the linkages

between interpersonal team processes and task orientation may be helpful for instructors who use TBL or other collaborative team-based strategies.

Overall, these results corroborate prior literature suggesting that effective teamwork is different from group-work (Oakley et al. 2004). While group members tend to work independently and pool their work together into a final product, often devoid of in-depth discussion, team members often work together as well as independently. The end product of teamwork often reflects deeper interdependent processes including communication, negotiation, conflict resolution, mutual support, and problem solving. Therefore, faculty teaching graduate-level health sciences courses that involve students working in groups should consider explicitly addressing principles of teamwork, encourage teams to develop their own working guidelines, and allot class time for students to complete peer evaluations, share feedback on team strengths and weaknesses, and discuss ways to address challenges the team faces in working together. Scheduling regular check-ins for teams throughout the semester allows teams to re-evaluate their guidelines and make course-corrections as needed.

While positive team dynamics are inherently desirable and may have contributed to students enjoying the learning environment in the research methods course, no association was found between team dynamics and students' academic performance. While this finding is in line with Vasan et al. (2009) results in a medial anatomy class that students' perceptions of teamwork were not associated with grades, it is counter to an assumption of TBL that teamwork will foster improved learning of course content (Michaelsen et al. 2004). Several explanations could account for this finding. First, this was generally a group of high achieving and highly motivated graduate students who may have performed well regardless of how well their team functioned. Second, the structure of TBL with weekly quizzes holds students accountable for pre-class preparation more so than other traditional courses. In fact, in the quantitative survey, about 60% of students reported reading consistently more for the research methods course than for other classes. This preparation, combined with a high achieving cohort of students, may have attenuated the variability in performance scores that could have been otherwise observed. Third, most teams, even those who encountered some challenges at first, reported that they worked well together, resulting in minimal variation in team dynamics scores.

The value of teamwork extends beyond short-term academic indicators. In the past decade, several leading and governing entities across disciplines released guidelines and recommendations specifically highlighting the value and necessity of team-based learning. Among various systemic shortcomings identified in professional education within the fields of medicine, nursing and public health, poor team work is highlighted as one important area requiring attention (Frenk et al. 2010). Results from our study suggest that integrating teamwork within the structure of a graduate-level health sciences course, including clear expectations and evaluations of teamwork, can facilitate skills acquisition beyond course content. Engaging in such courses, where awareness and discussion of team dynamics become normative, may prime students to accept, and indeed expect, that working in teams is inherent to being an effective professional. Courses that engage community partners as part of students' learning experience may be particularly well suited for a team-based learning approach.

Strengths and limitations

The strengths of this study include the mixed-methods approach that yielded rich and meaningful quantitative and qualitative data that converged well to describe students' experiences with team dynamics. The Team Dynamics scale resulted in strong reliability and a

well-supported two-factor structure consistent with prior literature. However, further development of a measure of team dynamics is warranted, given that a couple of the items did not load consistently on the two main factors. Additional items may be needed to further develop the third factor. Due to the limited sample size, as well as the nested nature of individual participants within teams, our ability to perform multilevel statistical tests to examine team-level dynamics and account for clustering was restricted. Additionally, a detailed within- and between-group analysis of team dynamics could not be conducted due to varied participation in the study across teams.

The qualitative data provided an in-depth understanding of student experiences, but should also be considered in light of some limitations. The number of focus groups was constrained by students' schedules and availability, and while we obtained rich qualitative data, it is possible that saturation was not reached. While participants represented numerous teams across the course sections, two focus groups included students from the same team, which may have hindered the sharing of honest perceptions.

Overall, generalizability may be limited to similar samples of public health students; most students in our program tend to either come directly after graduating with their undergraduate degrees or within a year or two of graduation.

Conclusion

Although positive team dynamics were not associated with student performance in this study, students stated that working in teams allowed them to learn important transferrable skills beyond performance on course assignments. Such skills include communication, negotiation, conflict resolution, perspective-taking, and problem solving. In light of new competencies in collaborative and interprofessional skills across health professions, it is important to build these skills into health sciences curricula in creative ways. Active learning approaches, such as team-based learning, help create learning environments that can facilitate collaborative team processes (Buhse and Ratta 2017). Therefore, it is important that teamwork principles and strategies become an integral part of health sciences graduate education, within and beyond public health, to prepare students to enter a complex, multidisciplinary, interprofessional, global workforce.

References

Association of Schools and Programs of Public Health. (2014). *A Master of Public Health degree for the 21st Century: Key considerations, design features, and critical content of the core*. Retrieved May 1, 2017, from http://www.aspph.org/app/uploads/2014/06/MPHPanelReportFINAL_2014-11-03REVISEDfinal1.pdf.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa.

Buhse, M., & Ratta, C. D. (2017). Enhancing interprofessional education with team-based learning. *Nurse Educator, 42*(5), 240–244. https://doi.org/10.1097/NNE.0000000000000370.

Carless, S. A., & De Paola, C. (2000). The measurement of cohesion in work teams. *Small Group Research, 31*(1), 71–88. https://doi.org/10.1177/104649640003100104.

Chang, A., & Bordia, P. (2001). A multidimensional approach to the group cohesion-group performance relationship. *Small Group Research*, *32*(4), 379–405.

Chapman, K. J., Meuter, M., Toy, D., & Wright, L. (2006). Can't we pick our own groups? The influence of group selection method on group dynamics and outcomes. *Journal of Management Education, 30*(4), 557–569. https://doi.org/10.1177/1052562905284872.

Commission on Collegiate Nursing Accreditation. (2018). *Standards for accreditation of baccalaureate and graduate nursing programs*. Retrieved November 6, 2018, from https://www.aacnnursing.org/Portals/42/CCNE/PDF/Standards-Final-2018.pdf.

Considine, J., Payne, R., Williamson, S., & Currey, J. (2013). Expanding nurse initiated X-rays in emergency care using team-based learning and decision support. *Australasian Emergency Nursing Journal, 16*(1), 10–20.

Council on Education for Public Health. (2016). *Accreditation criteria: Schools of public health and programs of public health*. Retrieved May 1, 2017, from https://ceph.org/assets/2016.Criteria.pdf.

Davidson, L. K. (2011). A 3-year experience implementing blended TBL: active instructional methods can shift student attitudes to learning. *Medical Teacher, 33*(9), 750–753.

Fatmi, M., Hartling, L., Hillier, T., Campbell, S., & Oswald, A. E. (2013). The effectiveness of team-based learning on learning outcomes in health professions education: BEME Guide No. 30. *Medical Teacher, 35,* e1608–e1624. https://doi.org/10.3109/0142159X.2013.849802.

Frenk, J., Chen, L., Bhutta, Z. A., Cohen, J., Crisp, N., Evans, T., et al. (2010). Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *The Lancet, 376*(9756), 1923–1958. https://doi.org/10.1016/S0140-6736(10)61854-5.

Haidet, P., Kubitz, K., & McCormack, W. T. (2014). Analysis of the team-based learning literature: TBL comes of age. *Journal on Excellence in College Teaching, 25*(3–4), 303.

Hrynchak, P., & Batty, H. (2012). The educational theory basis of team-based learning. *Medical Teacher, 34*(10), 796–801.

Huitt, T. W., Killins, A., & Brooks, W. S. (2015). Team-based learning in the gross anatomy laboratory improves academic performance and students' attitudes toward teamwork. *Anatomical Sciences Education, 8*(2), 95–103.

Interprofessional Education Collaborative. (2016). *Core competencies for interprofessional collaborative practice: 2016 update*. Washington, DC: Interprofessional Education Collaborative.

Kalaian, S. A., & Kasim, R. M. (2017). Effectiveness of various innovative learning methods in health science classrooms: A meta-analysis. *Advances in Health Sciences Education, 22*(5), 1151–1167. https://doi.org/10.1007/s10459-017-9753-6.

Lang, D. L., Walker, E. R., Steiner, R. J., & Woodruff, R. C. (2018). Implementation and mixed-methods evaluation of Team-Based Learning in a graduate public health research methods course. *Pedagogy in Health Promotion, 4*(2), 140–150. https://doi.org/10.1177/2373379917707222.

Michaelsen, L. K., Knight, A. B., & Fink, L. D. (2004). *Team-based learning: A transformative use of small groups in college teaching*. Sterling, VA: Stylus.

Michaelsen, L. K., & Sweet, M. (2008). The essential elements of team-based learning. *New Directions for Teaching and Learning, 116,* 7–27. https://doi.org/10.1002/tl.330.

Oakley, B., Felder, R. M., Brent, R., & Elhajj, I. (2004). Turning student groups into effective teams. *Journal of Student Centered Learning*, *2*(1), 9–34.

Palincsar, A. S. (1998). Social constructivist perspectives on teaching and learning. *Annual Review of Psychology, 49*(1), 345–375.

Peters, M. (2000). Does constructivist epistemology have a place in nurse education? *Journal of Nursing Education, 39*(4), 166–172.

Reimschisel, T., Herring, A. L., Huang, J., & Minor, T. J. (2017). A systematic review of the published literature on team-based learning in health professions education. *Medical Teacher, 39*(12), 1227–1237. https://doi.org/10.1080/0142159X.2017.1340636.

Salas, E., Grossman, R., Hughes, A. M., & Coultas, C. W. (2015). Measuring team cohesion: Observations from the science. *Human Factors, 57*(3), 365–374. https://doi.org/10.1177/0018720815578267.

Schulz, A. J., Israel, B. A., & Lantz, P. (2003). Instrument for evaluating dimensions of group dynamics within community-based participatory research partnerships. *Evaluation and Program Planning, 26*(3), 249–262. https://doi.org/10.1016/S0149-7189(03)00029-6.

Sisk, R. J. (2011). Team-based learning: Systematic research review. *Journal of Nursing Education, 50,* 665–669. https://doi.org/10.3928/01484834-20111017-01.

Thibault, G. E. (2015). Public health education reform in the context of health professions education reform. *American Journal of Public Health, 105*(S1), S8–S10.

Thompson, B. M., Haidet, P., Borges, N. J., Carchedi, L. R., Roman, B. J., Townsend, M. H., et al. (2015). Team cohesiveness, team size and team performance in team-based learning teams. *Medical Education, 49*(4), 379–385. https://doi.org/10.1111/medu.12636.

Touchet, B. K., & Coon, K. A. (2005). A pilot use of team-based learning in psychiatry resident psychodynamic psychotherapy education. *Academic Psychiatry, 29*(3), 293–296.
Tuckman, B. W. (1965). Developmental sequence in small groups. *Psychological Bulletin, 63*(6), 384. https://doi.org/10.1037/h0022100.
Vasan, N. S., DeFouw, D. O., & Compton, S. (2009). A survey of student perceptions of team-based learning in anatomy curriculum: Favorable views unrelated to grades. *Anatomical Sciences Education, 2*(4), 150–155.
Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Affiliations

Elizabeth Reisinger Walker[1] · Delia L. Lang[1] · Bethany A. Caruso[2] · Leslie Salas-Hernández[1]

Delia L. Lang
dlang2@emory.edu

Bethany A. Caruso
bcaruso@emory.edu

Leslie Salas-Hernández
leslie.kristina.salas@emory.edu

[1] Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Emory University, 1518 Clifton Ave, Atlanta, GA 30322, USA

[2] Hubert Department of Global Health, Rollins School of Public Health, Emory University, 1518 Clifton Ave, Atlanta, GA 30322, USA