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Diverse Teams, Team Effectiveness, and the Moderating Effect of Organizational Support

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Diverse Teams, Team Effectiveness, & the Moderating Effect of Organizational Support

By

Hannah Tilstra

A Thesis Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

In

Industrial Organizational Psychology

Minnesota State University, Mankato

Mankato, Minnesota

May 2020

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Diverse Teams, Team Effectiveness, and the Moderating Effect of Organizational
Support

Hannah Tilstra

This thesis has been examined and approved by the following members of the student's
committee.

Advisor

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OF ORGANIZATIONAL SUPPORT.

HANNAH TILSTRA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS IN INDUSTRIAL ORGANIZATIONAL PSYCHOLOGY

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Abstract

This study adds to the growing literature on diversity in teams and team effectiveness. This study reviews the literature examining theoretical perspectives of diversity in teams, surface-level diversity attributes, team training and team outcomes. To test hypotheses, an archival dataset from a study focusing on team training, which is coded to represent the presence of gender and ethnic diversity on teams. Variables including team performance, shared mental models, and team behavioral processes are used to measure team effectiveness. The results of this analyses suggest mixed results, but do indicate that teams with diversity are more effective, particularly in measures of coordination, interaction mental models, and transition processes. Teams with gender diversity are shown to outperform teams without gender diversity for most measures, while teams with ethnic diversity only outperformed teams without ethnic diversity on transition processes. When teams received training, diverse teams were shown to be more effective than homogenous teams for measures of coordination and team interaction accuracy mental models. These results indicate a need for further research on the impact team training and other forms of organizational support has for diverse teams. Practically, these results also suggest that diverse teams are more effective than homogenous teams in many areas, and that team training is a viable option for organizations looking to improve diverse team effectiveness.

Introduction

The last century has seen major changes in the workforce: technology has grown, businesses have expanded beyond their national boundaries, equality initiatives have surfaced, and organizations now, more than ever, employ people of varied races, ages, sexes, genders, and religions. These changes have created new challenges in the workplace. Research related to benefits and difficulties present within diverse organizations is important (Christian, Porter, & Moffit, 2006). Particularly relevant perhaps, is research that can be prescribed to improve diverse team functioning in this evolving, diverse workforce. One area that addresses this need is research on organizational initiatives that can support diverse team effectiveness.

Theoretical Perspectives.

Findings from the literature on workplace diversity are, ironically, diverse. These broad research findings are likely due to the complexity of the construct and frequent oversimplification of this complex topic by researchers (Bell et al., 2010). Although researchers have been studying the implications of diversity in the workforce for decades, studies produce mixed results which can be confusing to untangle. Most researchers study diversity by looking for differences between various attributes individuals in a group possess and focus on ideas grounded in one of three theoretical perspectives (Horwitz & Horwitz, 2007; Ely & Thomas, 2001).

The similarity attraction paradigm (Byrne, 1971), social categorization theory (Tajfel, 1969; Tajfel & Turner, 1979), and the informational diversity-cognitive resource

perspective (Cox & Blake, 1991) lend themselves to opposing outcomes in diversity research.

Both the similarity attraction paradigm and the social categorization theory suggest that increased levels of diversity may decrease positive team outcomes. The similarity attraction paradigm claims that we are attracted to people who are like us (Wiersema & Bantel, 1992). Similarly, social categorization theory states that people naturally categorize others into subgroups. For diverse work groups, this implies that team members will categorize each other into different groups, potentially forming an in-group out-group bias and ultimately, decreasing productivity due to subgroup dynamics (Brewer, 1979; Brewer, 1995; Knippenberg et al., 2004). Based on social categorization theory, McGrath's Expectation Model (1995) goes further to suggest a negative link in team performance and biodemographic diversity due to stereotypes, or expectations, individuals possess about the other member's social category.

In contrast to the aforementioned theories, the informational diversity – cognitive resource perspective states that demographic diversity can improve productivity (Cox & Blake, 1991). The informational diversity – cognitive resource perspective is the idea that differences in demographics indicate a wider range of perspectives and information that can be used by the group. In this case, diversity can contribute to group success, rather than hinder it (Cox & Blake, 1991). Based on these theoretical perspectives, the type of diversity (either job-related or less job-related demographic attributes) is thought to relate to performance, (Pelled, 1996). Research that is informed by the information diversity-cognitive resource perspective largely focuses on deep-level attributes of diversity,

however, little research on the impact team training may have on inducing understanding of deep-level attributes has been conducted.

These theoretical perspectives support different conclusions, but all three agree that there is evidence of a relationship between diversity and performance. The social categorization theory and the similarity-attraction paradigm support a negative relationship between diversity and performance (Price, Harrison, Gavin, & Florey, 2002; Simons, Pelled, & Smith, 1999; Wiersema & Bantel, 1992). However, using the informational diversity – cognitive resource perspective, Bantel (1994) suggests that greater levels of diversity result in better team performance. Other researchers have agreed with this notion, stating that certain attributes result in greater team performance (Price et al., 2002; Mohammed & Angell, 2004). These results indicate that the operationalization of diversity and team outcomes is important in distinguishing the effects of diversity; they also indicate that further analysis of mediators and moderators of diverse workgroups are necessary for a better understanding and application of diversity literature.

This study will focus on the informational diversity – cognitive resource perspective, which hypothesizes that diverse teams will perform better than homogenous teams due to the varying perspectives of team members.

Diversity Defined.

Before further understanding the impacts of diversity, one must know how to define diversity. One simple definition of diversity is “the condition of having or being composed of differing elements or qualities” (Merriam-Webster, 2003). For the purpose

of defining workplace diversity, this definition is not enough. In organizational and professional environments, diversity can be best described as the distributional differences among members of a team along a common attribute (Harrison & Klein, 2007). In the context of team diversity, diversity is an umbrella term for the level of heterogeneity or homogeneity team members' attributes provide the group.

Dimensions of Diversity.

Dimensions of diversity vary throughout the literature. Researchers have categorized diversity paradigms along spectrums of biodemographic and task-related diversity; heterogeneity or sub-group differences; heterogeneity vs. homogeneity; detectable vs. undetectable; levels of visibility vs. job relatedness; observable individual differences vs. underlying attributes, and many others (Ely & Thomas, 2001; Kanter, 1977; Pelled, Eisenhardt & Xin, 1999, Bell, Villado, Lukasik, Belau, & Briggs, 2010). Despite the broad range of characteristics operationalized in diversity literature, the bulk of diversity research can be understood as focusing on either demographic diversity, psychological diversity, and organizational diversity. Demographic diversity is defined as characteristics of individuals easily diagnosed by others as similar or different to themselves (e.g. race, sex, age, etc.). Psychological diversity is defined as characteristics that contribute to the way an individual perceives job-related tasks and approaches situations (e.g. personality traits, values, beliefs, etc.). Organizational diversity is defined as attributes and differences in understanding of an individuals' work based on their experience (e.g. education, work experience, organizational tenure, etc.), (Jackson, Joshi, & Erhardt, 2003; Milliken & Martins, 1996; Steward, 2006; Williams & O'Reilly, 1998).

These three categories of diversity can be, and often have been, simplified by dichotomizing diverse attributes as either surface-level or deep-level diversity (Milliken & Martens, 1996; Ely & Thomas, 2001; Mohammed & Angell, 2004). Surface-level diversity

accounts for diverse attributes that are visible and identifiable immediately (race, age, sex, etc.), while deep-level diversity accounts for attributes under the psychological and organizational diversity umbrellas. Deep-level diversity is made up of all the unseen aspects of diversity that influence an individual's perspective (education, personality, values, work experience, etc.) (Mohammed & Angell, 2004). This study uses this dichotomy of diversity, surface-level and deep-level attributes, in its understanding of diversity in teams.

Deep Level Diversity.

Deep-level diversity attributes have the strongest link to positive impacts on teams and team performance (Mohammad & Angell, 2004; Horwitz & Horwitz, 2007). However, like most diversity research, this link is only present under specific circumstances. One such circumstance occurs when teams have been together for a long time. In cases where teams have been together for some time, teams with more deep-level diversity perform better and are more cohesive. Researchers speculate that this is due to the fact that teams have had time to identify and use each other's knowledge and background; it's likely that deep-level attributes are not identified by members in the short term, and thus are not as immediately impactful on team outcomes as other factors (Mohammad & Angell, 2004). Research shows support for this idea, indicating that homogenous teams have been found to perform better than diverse teams in the short term (Simons, Pelled, & Smith, 1999).

In contrast, the purpose of a team affects whether deep-level diversity attributes, specifically role-related knowledge and skill, have positive impact on team outcomes. In this case, teams that have high levels of task diversity within the team structure are more productive and more cohesive than teams that are low in task diversity (Mohammed & Angell, 2004; Bell, Villado, Lukasik, Belau, and Briggs, 2010).

Deep-level diversity covers attributes such as personality traits (often measured by Big Five personality traits), values, morals, beliefs, and organizational function and tenure (Mohammed & Angell, 2004). The impact of these attributes on team functioning is again mixed. Generally, deep-level diversity produces the strongest link between diversity and positive team outcomes. It's speculated that this occurs because teams develop knowledge of members' deep-level attributes over time through observation of behavior and disconfirmation of stereotypes formed from initial surface-level attributes (Bell et al., 2010).

Surface Level Diversity.

Overall, the effects identified by surface-level diversity research are inconsistent. This is likely because surface-level diversity attributes affect people immediately, and often unconsciously (Mohammed & Angell, 2004; Bell et al., 2010; Simons et al., 1999). However, research is clear that when it comes to surface-level attributes, people are drawn to others most like themselves and thus form stronger initial attachments to those with the most similarity to themselves (Simmons et al., 1999, Salazar, Feitosa, and Salas, 2017). Likely, for better or worse, a majority of the effects from surface-level diversity are caused by individual schemas, stereotypes, and heuristics.

Research shows that increasing surface-level diversity among members of a team tends to create greater perceptions of interpersonal conflict, decrease communication, decrease cohesion, and increase perceptions of disrespectful behavior. Pelled (1996) was the first to identify that the more visible a diverse attribute, the stronger the association the attribute has with relationship conflict. Other research related to surface-level diversity has identified negative effects of heterogeneity of gender, age, ethnicity, and

racial diversity on relationship conflict (Pelled, 1996; Jehn & Bezrukova, 2004; Thatcher, Jehn, & Zanutto, 1998).

In time, these surface level diversity effects have been shown to mitigate themselves as deep-level diverse attributes become more prominent (Pelled, 1996). This pattern may result because surface-level attributes tend to have a greater impact on initial impressions among team members than deep-level attributes. Additionally, surface-level attributes have more negative, culturally reinforced associations linked to them.

However, when analyzed in a meta-analytic fashion, the effects of surface-level attributes on team effectiveness are inconsistent. Horwitz and Horwitz (2007) found no relationship with bio-demographic (surface-level) diversity and team performance quality and quantity. The relationship between surface-level diversity and other areas of team performance produced inconclusive results. In general, this research has focused on surface-level attributes as one category of diversity, but upon further analysis, surface-level attributes are an overarching category of many demographic traits, including race, age, and gender. (Horwitz & Horwitz, 2007). These traits may be best researched separately, given that in minority groups, each trait has different cultural stereotypes associated with it.

When researchers examine specific individual attributes of surface-level diversity, a clearer picture of these attributes' implications is portrayed. An overview of the two most commonly studied surface-level attributes (gender, race and ethnicity) is provided below.

Racial & Ethnic Diversity.

Research on racial diversity reveals effects on team outcomes, but little research has been conducted on specific team outcomes, including performance (Williams & O'Reilly, 1998). Pelled (1999) found that racial diversity was related to higher levels of emotional conflict in teams. Williams and O'Reilly (1998) on the other hand, reported contrasting results – stating that high levels of racial diversity had no relationship or even a positive relationship with team outcomes. However, Williams and O'Reilly (1998) also stated that most evidence supports the idea that racial heterogeneity has negative effects on team outcomes. They qualify this information by reporting that the negative effects of racial heterogeneity are mitigated, and even eliminated in some cases, if the conflict is handled appropriately (Timmerman, 2000). Traditionally, research supports the idea that racial diversity has negative effects on team outcomes, however, recent research has highlighted the need for research on the effects of racial diversity on team performance with attention to additional factors including length of time together as a group, task type, and specific types of ethnic diversity to come to more conclusive results (Bell et al., 2010; Timmerman, 2000; Williams and O'Reilly, 1998).

Gender Diversity.

Gender diversity research indicates gender diversity significantly impacts team performance, but how, is highly debated amongst researchers.

Some research indicates that though gender diversity may impact some team performance outcomes positively, gender diversity may negatively impact team processes, such as coordination and communication (Hamilton et al., 2003). In more

recent years, Adams and Ferreira (2009) used a field study to analyze the impact of gender diversity on board success in several industries. Their results indicated that overall, higher levels of gender diversity had a negative relationship with RoA (return on assets).

In contrast, Hansen, Owan, and Pan (2006) in a study of student groups working towards grades on a group assignment found that man-dominated groups performed worse as a group than both diverse groups *and* woman-dominated groups. Similarly, Hoogendoorn, Hessel, and Mirjam (2013) conducted a study which determined that gender heterogeneous teams outperformed man-dominated, homogenous teams. Many researchers agree that gender heterogeneity leads to higher levels of performance in teams and may lead to other positive team outcomes (Hamilton et al., 2003; Adams & Ferreira, 2009).

Studies of team process indicate that gender heterogeneous groups were more generous and egalitarian, among other factors (Dufwenberg & Muren, 2006). Additionally, it should be noted that many studies have suggested that mediating factors, (such as team tenure and personality traits of team members), may influence team outcomes for gender heterogeneous teams (Pelled et al., 1999). The research on gender diversity in teams is mixed in results, with many confounding variables. However, it's important to understand that most studies consistently find an effect on team outcomes and processes when teams are evenly mixed between men and women – whether that effect is negative or positive may be dependent on situational factors.

Surface Level Attributes Summarized.

Many researchers have broken down attributes related to surface-level diversity and team outcomes to determine how certain types of diversity affect team performance (Amason, Shrader & Tompsen, 2006; Ancona and Caldwell, 1992; Bell, 2007; Edwards et al. 2006; Ensley, and Hmieleski 2005; Hamilton, Nickerson, and Owan, 2012). The results of these studies are primarily negative, but the impact of specific attributes vary. There are many reasons why surface-level diversity in the workplace, although contradictory in its results, is still important for future study. Primarily, this is because surface-level attributes (e.g. race, gender, etc.) tend to cause more disadvantages for minority groups in the workplace than deep-level attributes (e.g. values, beliefs, functional background, etc.). This is widely due to heuristics, stereotypes and unconscious biases play into these visible attributes more than other, less visible characteristics (Mohammed & Angell, 2004; Bell, 2007; Hamilton et al., 2012).

It should also be noted that very little research exists to identify to what extent organizational supports can overcome the negative effects surface-level diversity may create. This study aims to shed a light on the impact team training may have on diverse team effectiveness.

Mediators and Moderators of Team Diversity

In recent years, diversity researchers have shifted from identifying main effects of diversity and have decided to look at mediators and moderators of diverse team performance. Mediators and moderators are a third variable that will impact the strength and direction of the relationship between team heterogeneity and team effectiveness

(Knippenberg & Schippers, 2007). This shift in approach is typically due to the lack of consistent findings among diversity researchers.

Analysis of mediation and moderation effects on diversity suggest a need for additional research on factors which impact diverse team success (Horwitz & Horwitz, 2007; Salazar et al., 2017; Wegge & Shemla, 2015; Wegge & Shemla, 2019; Price et al., 2002; Hentschel, Shemla, Wegge & Kearney, 2013). One such area that could benefit teams would be the moderating effect team training (and other organizational support initiatives) has on performance for diverse teams, which may consequently impact team perceptions of diversity. For example, it can be expected that organizational training efforts designed to help team members identify their unique roles/expertise would promote shared understanding among team members where it is lacking, thus improving team effectiveness and team outcomes. It is important that research is conducted to determine whether team training is indeed beneficial for diverse teams with high variance in surface – level attributes. The purpose of the current study is to examine the affect organizational support, such as team training, will have on the relationship between surface – level diversity and team effectiveness.

Team Research.

Much of team diversity research, and team research in general, has focused on the impact various attributes of teams have on team effectiveness. Results of team diversity studies are mixed, but many speculate that this is due to differences in the categorization of diversity in various studies, team characteristics, team purpose, and other team-specific

factors (Bell, 2007) - for the purpose of team diversity research, this is why it's important to clarify what is meant by team, and consequently, team effectiveness.

Defining Team.

Researchers can define team loosely or specifically, but most accept that the definition of 'team' refers to two or more individuals who interact socially, possess common goals, and perform tasks that are organizationally relevant. To be deemed a 'team,' individuals within the group must also exhibit some sort of interdependence in respect to their workflow, outcomes, purpose, and goals (Salas, 2008).

The nature of a team requires teams to follow a process to complete their purpose. Hackman & Morris (1975) indicated teams go through three phases: First, a team must determine what 'inputs' they will provide to aid in the process the team embarks on. Second, the team completes a 'process' in which they work toward accomplishing a goal. When the process is completed, team 'outputs' are produced. Often, these outputs are the result of a team accomplishing its goals. The quality of these outputs are how team effectiveness and performance are evaluated (Hackman & Morris, 1975).

According to this model, multiple factors can impact effectiveness. Most relevant to the purpose of this study is team composition. Team composition refers to the balance (or imbalance) of team members' knowledge, skills, abilities, and other identifying characteristics as each relates to the team purpose (Hackman & Morris, 1975; Ensley et al., 2005; Amason et al., 2006). Surface-level diversity directly contributes to team composition. Aspects of team composition that will be investigated in this study include the presence of diversity in two surface – level attributes (gender and ethnicity).

Team Training Research.

In addition to the recent surge in team diversity research, team training has been consistently examined to determine optimal types of training and team building interventions to improve team outcomes and processes. Team training has been defined as a set of strategies that create a context in which team skills can be practiced, assessed and learned (Salas & Cannon-Bowers, 1997). The way team training is used and implemented varies across teams depending on the goal of the training and the structure of the team (Stevens & Yarish, 1999).

Salas, E., DiazGranados, D., Klein, C., Burke, C. S., Stagl, K. C., Goodwin, G. F., & Halpin, S. M. (2008) comprehensively analyzed the impact of team training on team outcomes. After conducting a metaanalytic study on the effectiveness of team training strategies the analysis determined that team training is effective in improving team outcomes; thus, team training works. Based on this comprehensive analysis, this conclusion stands regardless of type of team training/training content and team outcomes (Salas et al., 2008).

Types of Team Training.

This study will use an archival dataset from a previous study which used two types of team training to analyze diverse team outcomes: interpositional and interactional training. Both forms of team training are designed to help teams improve performance, but the catalyst for improving performance changes depending on the training strategy (Salas & Cannon-Bowers, 1997; Cannon-Bowers & Salas, 2000; Salas, et al., 2008). Interpositional training builds team members' knowledge of different members' roles,

which in turn improves team understanding of collective responsibilities (Volpe, Cannon-Bowers, Salas, & Spector, 1996). On the other hand, interactional training aims to improve team performance by developing behavioral strategies and knowledge of effective teamwork skills (Fowlkes et al., 1994; Salas & Cannon-Bowers, 2000). The effects of team training (both interpositional and interactional) may cause diverse teams to acknowledge and become aware of deep – level diverse attributes which may lead to more positive team outcomes.

Team Outcomes.

Team outcomes allow us to measure team success in a variety of areas. Salas et al. (2008) identify outcomes as either cognitive, affective, process, or performance. It's important to note that some researchers have compiled process and performance outcomes into one category, deeming them “skill-based” outcomes (Kraiger, Ford, & Salas, 1993). This study will focus on task completion, cognitive team outcomes, and skill-based team outcomes for diverse teams. Specific variables analyzed in this study include overall team performance, shared mental models, and team behavioral processes.

Team Performance.

Team performance is often assessed by determining whether, and how well, a team was able to achieve it's goal. For the purposes of this study, two measures of performance, total team points and total team kills earned on a video game simulation activity, will be used.

Shared Mental Models.

Mental models are the structures that team members develop to translate information regarding team and team performance requirements. These models may be defined by connecting team purposes, team characteristics, and team collective actions required by individual members to successfully complete their team purpose (Zaccaro, Ardison, & Orvis, 2004, p. 279; Cannon-Bowers, Salas, & Converse, 1993; Klimoski & Mohammed, 1994). When a team has a shared mental model, it means that team members understand team characteristics, purposes, and collective actions similarly; they have a shared understanding of knowledge, beliefs, perceptions, and expectations related to team performance— in other words, these teams are “on the same page” (Klimoski & Mohammed, 1994).

Both interpositional training and interactional training directly contribute to the development of shared mental models among team members (Volpe et al., 1996; McCann, Baranski, Thompson & Pigeau, 2000; Marks et al., 2000). Several types of mental models have been identified in previous research: equipment, task, team-role, and team-interaction (Cannon-Bowers et al., 1993). Team-role and team-interaction mental models are used as shared mental model outcomes in this study.

In the context of diverse teams, shared mental models are particularly important given each team member brings a different perspective based on their individual attributes and experience. Despite the importance of the development of these shared mental models in diverse teams, little research has been done to determine whether team training impacts the quality of shared mental models for diverse teams.

Team Behavioral Processes.

Team behavioral processes are directly impacted by the development and use of shared mental models; the knowledge team members possess from shared mental models should allow them to integrate and coordinate their behaviors to work together more effectively (Marks et al., 2000; Rittman, 2004). Team processes are the ways members work together (and rely on one another) to collectively use the resources they have amongst themselves to achieve their goal. Marks et al., (2001) identified two phases of team performance in which team processes occur: transition and action. Transition phases are portions of time when teams focus on strategizing and evaluating plans to achieve their goal (Marks et al., 2001). Action phases are portions of time in which teams are actively carrying out their plans and lead directly to goal accomplishment (Rittman, 2004; Dickinson & McIntyre, 1997). The main purpose of action processes is to align team members efforts and roles to reach their goal and complete their purpose. This study uses three measures of team behavioral processes: average scores from all transition processes, average scores from all action processes, and a measure of team coordination.

Hypotheses

Results of previous diversity research indicate mixed results, due to the diverse nature of the construct and factors which influence team effectiveness. This study further explores diverse team effectiveness and identifies whether organizational support in the form of team training can moderate the relationship between surface-level diversity and team effectiveness. The two surface-level diversity attributes analyzed in this study are gender diversity and ethnic diversity.

Based on diversity research findings and diversity theory related to surface-level diversity attributes and team training, the following hypotheses are tested in this study.

Hypothesis 1: Teams with diversity will perform differently than homogenous teams.

Hypothesis 1a: Ethnically diverse teams with no training will be less effective than other teams.

Hypothesis 1b: Teams with gender diversity will be more effective than other teams.

Hypothesis 1c: Teams with gender diversity and no training will be more effective than teams with no gender diversity and no training.

Hypothesis 2: Organizational support (team training) will moderate diverse team performance; diverse teams with team training will be more effective than other teams.

Hypothesis 2a: Diverse teams who received team training will have better shared mental models than homogenous teams with team training.

Hypothesis 2b: Diverse teams who received team training will have better team processes than homogenous teams with team training.

Hypothesis 2c: Diverse teams with team training will be more effective than diverse teams with no training.

Methodology

This study used an archival data set from a previous analysis of team training (Rittman, 2004). Data includes 189 undergraduate students at a mid-Atlantic university

who were divided into 63 teams. 72 men and 117 women participated in the study. Participant ages ranged from 17 to 40 years, with a majority stating they were 18. Ethnicity was reported as either Caucasian/white, African American, Hispanic, Asian American, or 'other.' 52% of participants reported their ethnicity as white, while the remaining 48% reported their ethnicity as something other than white.

The Archival Study

The data set used in these analyses originated from a dissertation focused on identifying the impact of specific types of team training on shared types of mental models and behavioral processes. In total, 63 teams of three undergraduate students were analyzed in the study.

The experiment required participants to take part in a half-day session, in which they were placed on a team with two other participants and instructed to complete a series of assessments which measured demographics, personality, cognitive ability, and other individual variables. After completing the assessments, the teams assembled to complete the first of two videogame-based military "missions." These missions were designed to imitate two different military settings; teams completed both types of missions, order in which teams completed the missions was randomized. The study found no order effects based on the type of mission completed first. For each mission, team members were assigned a role: either as the 'army,' 'navy,' or 'air force.'

Once the first mission was completed, teams were required to watch a video training (either a control video, or a video which trained teams through interpositional,

interactional, or both interpositional and interactional training methods). After completing training, teams completed a second mission.

Missions were used to assess team performance and effectiveness (in the form of shared mental models and team behavioral processes). Total team points and team kills were identified using the videogame software. Team members were assessed on mental models separately and sharedness of mental models was compiled after receiving all three members' scores. Team role mental models were assessed through knowledge check questions about each position held on the team (army, navy, or air force). Team interaction mental models were assessed through a card sorting technique called concept mapping. Behavioral processes were assessed by trained raters using an established behaviorally anchored rating scale (BARs). These raters reviewed a recording of both sessions after the teams had completed the study; action processes were evaluated during missions, while transition processes were evaluated during preparation sessions.

Procedures

Teams were coded based on the presence of gender diversity and ethnic diversity. Since teams were made up of three individuals, the presence of gender diversity indicates that there is one member who identifies as a different gender than the others in the group. After coding, 20 teams were found to have no gender diversity, while 43 had gender diversity. Ethnic diversity was considered present when at least one member of the team identified themselves as an ethnicity other than white. In total, 13 teams had no ethnic diversity, while 50 had some ethnic diversity.

Table 1: Distribution of Teams with Gender Diversity

	Frequency	Percent	Cumulative Percent
No Gender Diversity	20	31.7	31.7
Gender Diversity	43	68.3	100.0
Total	63	100.0	

Table 2: Distribution of Teams with Ethnic Diversity

	Frequency	Percent	Cumulative Percent
No Ethnic Diversity	13	20.6	20.6
Ethnic Diversity	50	79.4	100.0
Total	63	100.0	

To determine the type of diversity in each team, teams were then coded as having either no diversity, gender diversity, ethnic diversity, or both gender and ethnic diversity. After teams were coded based on type of diversity (both ethnic and gender), there were a total of 4 teams with no diversity at all, 16 teams with ethnic diversity only, 9 with gender diversity only, and 34 with both gender and ethnic diversity. Once teams were coded by type of diversity, they were identified as having received training or not. For the purpose of simplicity, the three training conditions (interpositional, interactional, and both interpositional and interactional) in the original study were lumped into one total “received training” category. In total, 14 teams received no team training, while 49 received some type of team training. In the original study, teams who received the training benefited.

		Trained Teams		Untrained Teams	
		Gender Diversity	No Gender Diversity	Gender Diversity	No Gender Diversity
Ethnic Diversity	Gender & Ethnic Diversity	N = 28	No Gender Diversity & Ethnic Diversity N = 10	Gender & Ethnic Diversity N = 6	No Gender Diversity & Ethnic Diversity N = 6
	No Ethnic Diversity	Gender Diversity & No Ethnic Diversity N = 8	No Gender or Ethnic Diversity N = 3	Gender Diversity & No Ethnic Diversity N = 1	No Gender or Ethnic Diversity N = 1

Figure 1: Coding & Categorization of Teams by Diversity Type & Training

Teams then were coded based on the type of diversity they collectively had, and whether they received training. Figure 1 illustrates how teams will be coded into these categories, resulting in the ability to compare teams on gender diversity, ethnic diversity, and training. This coding resulted in eight categories of teams: (1) No diversity and no training, (2) Ethnic diversity and no training, (3) Gender diversity and no training, (4) Both ethnic and gender diversity and no training, (5) No diversity and training, (6) Ethnic diversity and training, (7) Gender diversity and training, and (8) Both ethnic and gender diversity and training. Table 3 (below) indicates the number of teams present in each category of training and type of diversity.

Table 3: Teams in Each Category based on Training and Diversity Type

Category	Frequency	Percent	Cumulative Percent
1. No Diversity, No Training	1	1.6	1.6
2. Ethnic Diversity, No Training	6	9.5	11.1
3. Gender Diversity, No Training	1	1.6	12.7
4. Both Ethnic & Gender Diversity, No Training	6	9.5	22.2

5. No Diversity, Training	3	4.8	27.0
6. Ethnic Diversity, Training	10	15.9	42.9
7. Gender Diversity, Training	8	12.7	55.6
8. Both Ethnic & Gender Diversity, Training	28	44.4	100.0
Total	63	100.0	

The archival data set used in the present study contained various measures of team variables to measure team effectiveness. Measures of team performance, shared mental models, and team processes are used in the current study.

Team Performance

The variables that were used as overall performance variables include total team kills and total team points for the second mission each team completed. Team points ranged from 20 to 170 points possible, with a mean score of 108.10. Higher team points indicate better performance. Team kills indicate how many targets were destroyed, where higher numbers indicate better performance. Scores ranged from 9 to 57 for each team, with a mean score of 28.47.

Shared Mental Models

Two measures of shared mental models were used in this analysis: (1) total team interaction accuracy, and (2) total team role accuracy (both for the second mission each team completed). Total team mental model interaction accuracy is defined as knowledge of member interactions or collective action needed to accomplish goals. Total team role accuracy is defined as knowledge about member roles, position capabilities, position responsibilities, strengths and weaknesses that influence goal accomplishment. (Rittman, 2004).

Team Behavioral Processes

Team behavioral processes (the interdependent acts members perform which convert to various cognitive, verbal, and behavioral actions, which are then directed towards the collective team goal) were measured using three variables measured after the second mission each team completed: (1) team average transition processes, (2) team average action processes, and (3) total coordinated kills. Team transition processes (comprised of three specific processes: mission analysis, goal specification, and strategy formulation and planning) and action processes (comprised of four specific processes: monitoring progress toward goals, systems monitoring, team monitoring and backup, and coordination) were measured using a team-level behaviorally anchored rating scales (BARS) in the original study. This study will look at an average score for each team's transition processes and action processes to establish overall behavioral process effectiveness. In addition, one of the four action processes measured in the original study, coordination, is specifically evaluated using a measure of total coordinated kills, which will be used to evaluate differences in coordination among teams with different types of diversity. This specific action process is assessed in this study to establish coordination amongst teams as they are performing; a specific process previous research suggests teams with high surface-level diversity may struggle with.

Table 4 indicates the mean, standard deviation, minimum, and maximum scores achieved by teams for each of the variables used to measure overall team performance, shared mental models, and team behavioral processes.

Table 4: Descriptive Statistics for Key Study Variables

	Minimum	Maximum	Mean	Std. Deviation
Total Team Points	20	170	108.10	43.51
Total Team Kills	9	57	28.47	11.92
Total Team Interaction Accuracy	19	85	62.11	15.00
Total Team Role Accuracy	10	57	35.94	10.14
Average Transition Processes	1.00	5.00	3.23	1.14
Average Action Processes	1.00	5.00	3.22	1.20
Total Coordinated Kills	1	11	6.52	2.76

Results

Hypotheses were tested using a series of one way ANOVAs and contrasts as necessary. Results of each hypothesis are detailed below.

Hypothesis 1: Teams with diversity will perform differently than homogenous teams.

Hypothesis 1 was tested with a one way ANOVA using type of diversity as the independent variable (no diversity, ethnic diversity, gender diversity, and both ethnic and gender diversity) and all performance variables as the dependent variables. For variables which indicated significant differences, a contrast comparing all teams with diversity (ethnic, gender, and both ethnic and gender) to those without diversity was performed. The combination of all diverse types of teams will be referred to as “Combined Diverse Teams.”

Team Performance

Results of the ANOVA indicated a significant difference in overall team performance based on type of diversity. Specifically, total team points ($F = 6.64, p = .001$) and total team kills ($F = 3.92, p = .013$) revealed significant differences between groups. A contrast comparing Combined Diverse Teams (teams categorized as having

gender, ethnic, or both types of diversity) to homogenous teams was conducted. The results of the contrast determined that Combined Diverse Teams and homogenous teams were significantly different in overall team performance for total team points ($t(59) = 2.71, p = .009$). Further analysis revealed that overall, Combined Diverse Teams ($M = 110.91, SD = 42.87$) scored higher on team points than homogenous teams ($M = 62.50, SD = 32.02$).

Diverse team types were individually examined to determine significant differences between specific diversity types and homogenous teams for total team points and team kills. The analysis determined that teams with gender diversity ($M = 150.00, SD = 15.81$) were significantly different from homogenous teams and scored the highest on team points ($M = 62.50, SD = 32.02; t(59) = 3.78, p < .001$), teams with both gender and ethnic diversity ($M = 110.88, SD = 42.45$) also significantly differed from homogenous teams ($M = 62.50, SD = 32.02; t(59) = 2.37, p = .021$). Teams with ethnic diversity ($M = 90.00, SD = 39.33$) did not significantly differ from homogenous teams on team points ($M = 62.50, SD = 32.02; t(59) = 1.28, p = .207$).

Combined Diverse Teams ($M = 29.42, SD = 11.58$) did not significantly differ from homogenous teams ($M = 19.75, SD = 8.66$) for total team kills ($t(58) = 1.70, p = .095$). However, teams with gender diversity ($M = 35.89, SD = 9.55$) did significantly differ from homogenous teams on team kills ($M = 19.75, SD = 8.66; t(58) = 2.410, p = .019$). Other specific types of diversity were not significantly different from homogenous teams on total team kills.

Shared Mental Models

Results of the ANOVA indicated mixed results in shared mental models. Team total interaction accuracy ($F = 2.89, p = .043$) was found to be significant across types of diversity. A contrast determined that Combined Diverse Teams ($M = 63.73, SD = 13.98$) did not significantly differ from homogenous teams ($M = 46.50, SD = 18.66$) on team interaction accuracy ($t(59) = 1.20, p = .237$). Similarly, specific types of diversity did not significantly differ from homogenous teams on interaction accuracy. The ANOVA determined that team total role accuracy ($F = .659, p = .580$) was not significantly different based on type of diversity.

Team Behavioral Processes

Results of the one way ANOVA indicated mixed findings for team behavioral processes. The ANOVA indicated the number of coordinated kills between teams was significantly different between groups ($F = 7.401, p < .001$). A contrast revealed that Combined Diverse Teams ($M = 6.73, SD = 2.74$) had a significantly ($t(59) = 2.88, p = .006$) greater number of total coordinated kills than homogenous teams ($M = 3.50, SD = 1.73$). Further contrasts analyzing specific types of diversity in comparison to homogenous teams for coordinated kills indicate that teams with gender diversity ($M = 9.33, SD = 1.00$) had significantly more coordinated kills than homogenous teams ($t(59) = 4.02, p < .001$), as did teams with ethnic and gender diversity ($M = 6.68, SD = 2.64; t(59) = 2.49, p = .016$). Those with ethnic diversity were not significantly different from homogenous teams for coordinated kills ($M = 5.38, SD = 2.55; t(59) = 1.39, p = .170$).

The ANOVA indicated that transition processes ($F = 1.541, p = .213$) and action processes ($F = .581, p = .630$) were not significantly different among teams.

These results indicate mixed support for Hypothesis 1. Figure 2 and Figure 3 display the mean scores for each group based on type of diversity for the two significant outcome variables, total team points and total coordinated kills. Descriptive statistics for these measures are in Table 5. When comparing the means, diverse teams of all types score higher than homogenous teams on total points and coordinated kills. These results also indicated that teams with gender diversity scored the highest, followed by teams with ethnic and gender diversity, and finally ethnic diversity.

Table 5: Mean Scores of Significant Study Variables based on Type of Diversity

Outcome Variable	Contrast Group	Category	Mean Score	Standard Deviation
Total Team Points	No Diversity		62.50	32.02
	Diversity	Ethnic Diversity	90.00	39.33
		Gender Diversity	150.00*	15.81
		Ethnic & Gender Diversity	110.88*	42.45
		Total	110.91*	42.87
Total Team Kills	No Diversity		19.75	8.66
	Diversity	Ethnic Diversity	22.63	10.44
		Gender Diversity	35.89*	9.55
		Ethnic & Gender Diversity	30.33	12.01
		Total	28.47	11.92
Total Team Interaction Accuracy	No Diversity		53.50	19.50
	Diversity	Ethnic Diversity	54.63	18.05
		Gender Diversity	67.56	13.00
		Ethnic & Gender Diversity	65.21	12.04
		Total	62.11	15.00
Total Coordinated Kills	No Diversity		3.50	1.73
	Diversity	Ethnic Diversity	5.38	2.55
		Gender Diversity	9.33*	1.00
		Ethnic & Gender Diversity	6.68*	2.64
		Total	6.73*	2.74

*Indicates means which a contrast found significantly different from homogenous 'no diversity' teams at a $p < .05$ level.

Hypothesis 1a: Ethnically diverse teams with no training will be less effective than other teams.

A one way ANOVA was conducted to determine the difference between teams' performance, shared mental models, and behavioral processes based on the presence of ethnic diversity and training.

Team Performance

Results of the ANOVA revealed no significant differences in both overall performance variables, total team points ($F = 1.30, p = .285$) and total team kills ($F = .87, p = .463$), based on ethnic diversity and training.

Shared Mental Models

Similarly, results of the ANOVA revealed no significant differences in total team interaction accuracy ($F = 1.50, p = .224$) and total role accuracy shared mental models ($F = .198, p = .897$) based on ethnic diversity and training.

Team Behavioral Processes

Results of the ANOVA revealed that behavioral processes differed between teams only for transition processes ($F = 3.60, p = .019$). A contrast comparing ethnically diverse teams (those with ethnic diversity and those with ethnic and gender diversity) to other untrained teams conducted to determine whether Hypothesis 1a is supported for the significant outcome variable, transition processes. Results of the contrast did identify a significant difference for transition processes between untrained teams with ethnic diversity ($M = 3.64, SD = 1.01$) and other untrained teams ($M = 3.37, SD = 1.10; t(57) = -2.53, p = .014$). Further analysis of comparing specific categories based on the presence of ethnic diversity on a team and whether teams received training or not. This analysis

determined that teams with training and ethnic diversity significantly differed from teams with ethnic diversity that were untrained ($M = 3.37$, $SD = 1.14$; $t(57) = 2.85$, $p = .006$). Similarly, untrained teams with ethnic diversity were significantly different in transition processes when compared to teams with no diversity and training ($M = 2.22$, $SD = .67$; $t(57) = 2.92$, $p = .005$); the specific means of team transition processes are detailed in Table 6 below, as well as illustrated in Figure 4. Further analysis of means indicated teams with no ethnic diversity score lower than teams with ethnic diversity on transition processes (regardless of training). Additionally, teams with ethnic diversity that were untrained also outscored untrained teams without ethnic diversity. These results directly contradict hypothesis 1a; suggesting that teams with ethnic diversity are more effective at planning and evaluating processes than homogenous teams.

Results of the ANOVA determined that action processes ($F = 1.59$, $p = .201$) and coordinated kills ($F = 1.50$, $p = .201$) were not significantly different between teams based on ethnicity and training.

Table 6: Hypothesis 1a: Mean Scores of Significant Study Variables based on Ethnic Diversity

Variable	Contrast Group	Category	Mean Score	Standard Deviation
Average Transition Processes	Other Groups	No Ethnic Diversity, No Training	2.80	1.33
		No Ethnic Diversity, Training	2.22*	.67
		Ethnic Diversity, Training	3.37*	1.14
		Total	3.37*	1.10
	Ethnic Diversity, No Training	Ethnic Diversity, No Training	3.64	1.01

* Indicates means which a contrast found significantly different from teams in the 'ethnic diversity, no training' category ($p < .05$).

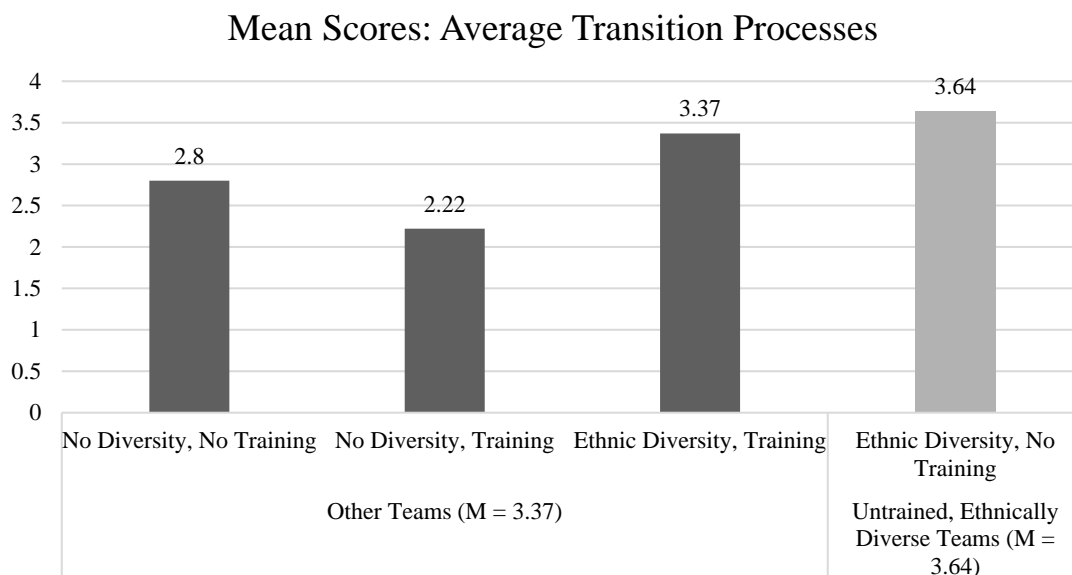


Figure 4: Mean scores for average transition processes based on presence of ethnic diversity and training. Means for contrast groups are indicated in the axis label.

Hypothesis 1b: Teams with gender diversity will be more effective than other teams.

An ANOVA comparing performance variables for teams with gender diversity and teams without gender diversity revealed mixed results.

Team Performance

Results of the ANOVA revealed that overall team performance was significantly different for both variables (total team points and total team kills) for teams based on the presence of gender diversity ($F = 9.85, p = .003$; $F = 9.80, p = .003$). A contrast found significant differences in both overall performance variables, total points ($t(61) = -3.14, p = .003$) and total team kills ($t(60) = -3.31, p = .003$). Mean scores for total team points indicated that teams with gender diversity ($M = 119.07, SD = 41.51$) performed better than teams without gender diversity ($M = 84.50, SD = 38.86$). The same is true for total

team kills; teams with gender diversity ($M = 31.52$, $SD = 11.65$) outperformed teams without gender diversity ($M = 22.05$, $SD = 9.96$).

Shared Mental Models

Results of the ANOVA revealed that shared mental models varied in significance based on the presence of gender diversity in teams: Team total mental model interaction accuracy was significant ($F = 8.71$, $p = .004$); mean scores for team interaction accuracy indicate that teams with gender diversity have better interaction accuracy ($M = 65.70$, $SD = 12.13$) than teams that do not have gender diversity ($M = 54.40$, $SD = 17.82$). Team total role accuracy did not significantly differ amongst groups ($F = 1.64$, $p = .205$).

Team Behavioral Processes

Results of the ANOVA revealed that team behavioral processes differed significantly amongst groups based on gender for coordinated kills ($F = 10.23$, $p = .002$), but not for transition or action processes ($F = .71$, $p = .403$; $F = 1.77$, $p = .189$). A contrast revealed a significant difference between groups based on gender diversity for total coordinated kills ($t(61) = -3.20$, $p = .002$). Mean scores indicate that teams with gender diversity ($M = 7.23$, $SD = 2.49$) had more coordinated kills than teams without gender diversity ($M = 5.00$, $SD = 2.62$).

Mean scores for each of the significant outcome variables, (team points, team kills, team interaction accuracy, and coordinated kills), are reported in Table 7; each significant outcome variable's means are illustrated in Figure's 5 – 8. The results of this analysis provide mixed results. However, of those significant outcome variables, total team points, total team kills, total team interaction accuracy, and average transition

processes, the results show that teams with high levels of gender diversity do perform better in these areas. These specific results are consistent with the literature on gender diversity in teams, which says that teams with gender diversity are more effective than homogenous teams.

Table 7: Hypothesis 1b: Mean Scores of Significant Study Variables for Gender Diversity

Outcome Variable	Category	Mean	Standard. Deviation
Total Team Points*	No Gender Diversity	84.50	38.86
	Gender Diversity	119.07	41.51
Total Team Kills*	No Gender Diversity	22.05	9.96
	Gender Diversity	31.52	11.65
Total Team Interaction Accuracy*	No Gender Diversity	54.40	17.82
	Gender Diversity	65.70	12.13
Total Coordinated Kills*	No Gender Diversity	5.00	2.49
	Gender Diversity	7.23	2.62

*Significant difference ($p < 0.05$) in performance based on group gender diversity.

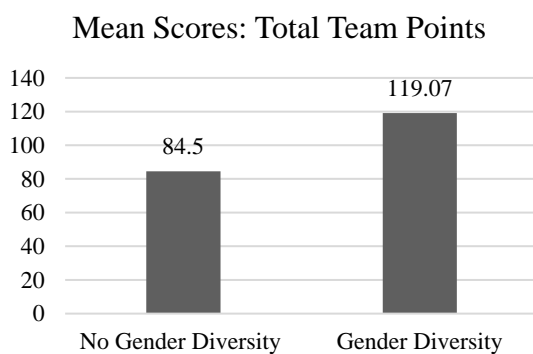


Figure 5: Mean scores for total team points based on presence of gender diversity in the team.

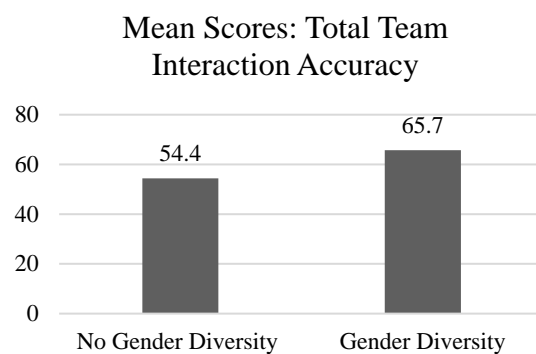


Figure 7: Mean scores for total team interaction accuracy based on presence of gender diversity in the team.

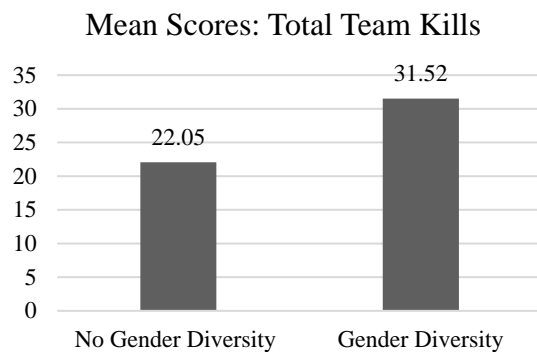


Figure 6: Mean scores for total team kills based on presence of gender diversity in the team.

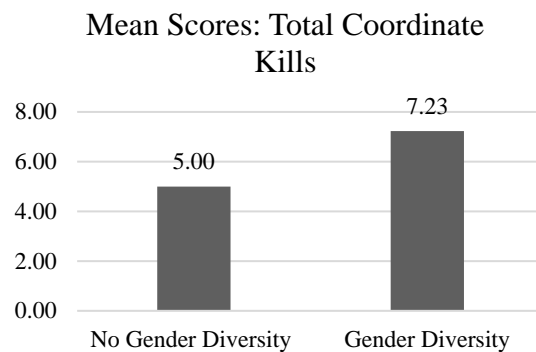


Figure 8: Mean scores for total coordinated kills based on presence of gender diversity in the team.

Hypothesis 1c: Teams with gender diversity and no training will be more effective than teams with no gender diversity and no training.

A one way ANOVA was conducted to test the difference between groups based on gender diversity and training. Significant variables were tested using a contrast comparing untrained teams with gender diversity to untrained teams without gender diversity.

Team Performance

Results of the ANOVA determined there were mixed results in team performance based on gender diversity. There was a significant difference in both overall team performance variables, total team points and total team kills ($F = 3.89, p = .013$; $F = 3.47, p = .022$). However, a contrast comparing untrained groups with gender diversity to untrained groups with no gender diversity determined that teams in these two categories did not significantly differ for total team points and total team kills, indicating that Hypothesis 1c is not supported for team performance ($t(59) = .79, p = .434$; $t(58) = 2.00, p = .051$).

Mean score trends indicate that teams with gender diversity and training ($M = 122.78$, $SD = 40.68$) scored higher than all other teams on team points; followed by teams with gender diversity and no training ($M = 100.00$, $SD = 43.59$), no diversity and training ($M = 85.38$, $SD = 43.13$); teams with no diversity and no training had the lowest scores for total team points ($M = 82.86$, $SD = 32.51$). Results were similar for total team kills, with mean scores indicating that trained team with gender diversity scored the highest ($M = 31.63$, $SD = 11.08$), followed by untrained teams with gender diversity ($M = 31.00$, $SD = 15.19$), trained homogenous teams ($M = 23.69$, $SD = 10.04$), with untrained homogenous teams scoring the lowest number of team kills ($M = 19.00$, $SD = 9.80$). These results are consistent with Hypothesis 1b, which determined that teams with gender perform better than other teams. This is also consistent with the literature.

Shared Mental Models

Results of the ANOVA determined there were mixed results for shared mental models. Total team interaction accuracy resulted in significant differences amongst groups based on gender ($F = 3.87$, $p = .014$). Results of a contrast indicate that total team interaction accuracy was significantly different between untrained teams with gender diversity and those without gender diversity ($t(59) = 2.49$, $p = .041$). Mean scores indicate that of untrained teams, those with gender diversity ($M = 45.14$, $SD = 16.16$) have better mental models than teams without gender diversity ($M = 39.14$, $SD = 18.79$); these means are recorded in Table 8 and illustrated in Figure 9. In these figures, mean scores of trained teams based on the presence of gender diversity are also included; these means also support previous research on gender diversity in teams and team

effectiveness, which have determined that team training improves shared mental models and teams with gender diversity often outperform teams without gender diversity.

Team total scores for role accuracy were not significantly different between groups ($F = .591, p = .623$).

Table 8: Hypothesis 1c: Mean Scores of Significant Study Variables for Training & Gender Diversity

Outcome Variable	Category	Mean Scores	Standard Deviation
Total Team Points	No Diversity, No Training	82.86	32.51
	No Diversity, Training	85.38	43.13
	Gender Diversity, No Training	100.00	43.59
	Gender Diversity, Training	122.78	40.68
Total Team Kills	No Diversity, No Training	19.00	9.80
	No Diversity, Training	23.69	10.04
	Gender Diversity, No Training	31.00	15.19
	Gender Diversity, Training	31.63	11.08
Total Team Interaction Accuracy*	No Diversity, No Training	39.14	18.79
	No Diversity, Training	51.85	26.89
	Gender Diversity, No Training	45.14*	16.16
	Gender Diversity, Training	62.61	21.47
Average Transition Processes	No Diversity, No Training	2.19	1.15
	No Diversity, Training	3.51	.98
	Gender Diversity, No Training	2.67	.69
	Gender Diversity, Training	3.44	1.14
Total Coordinated Kills	No Diversity, No Training	4.86	1.95
	No Diversity, Training	5.08	2.81
	Gender Diversity, No Training	5.86	2.55
	Gender Diversity, Training	7.50	2.58

* Indicates means which a contrast found significant difference between the 'gender diversity, no training' category and the 'no diversity, no training' category ($p < .05$), supporting Hypothesis 1c.

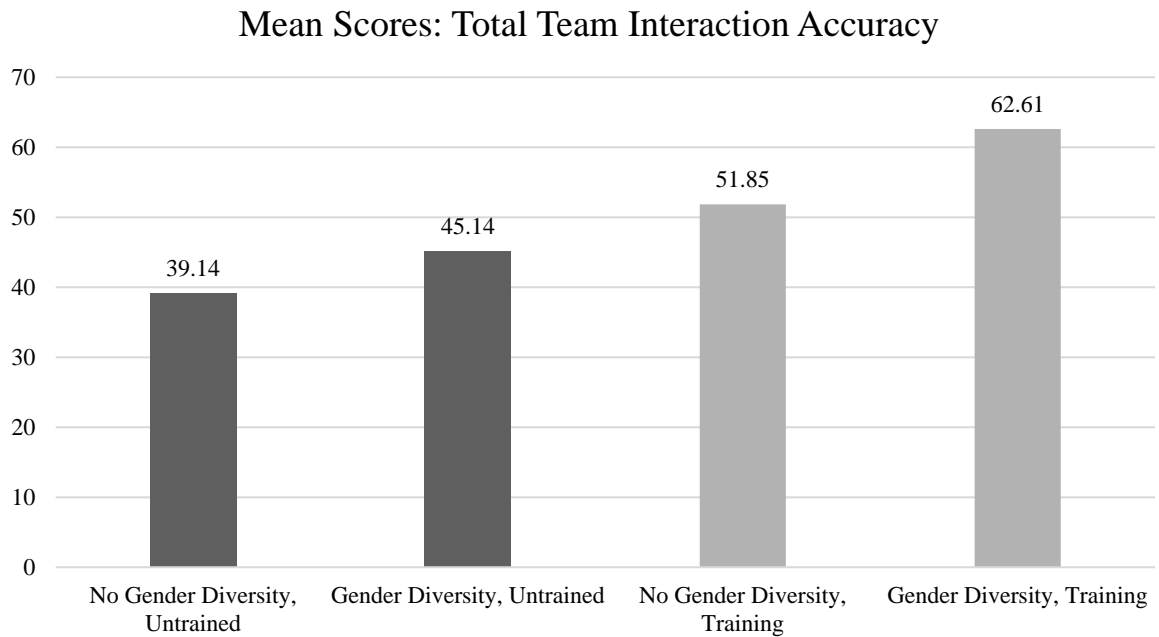


Figure 9: Mean scores of total team interaction accuracy based on the presence of gender diversity and training. Variables used in the contrast tested in Hypothesis 1c are indicated in dark grey.

Team Behavioral Processes

Results of the ANOVA determined team behavioral processes were significantly different between groups for transition processes and total coordinated kills ($F = 3.57, p = .019$; $F = 4.24, p = .009$). However, a contrast comparing groups with no training and gender diversity to those with no training and no gender diversity determined that teams in these two categories did not significantly differ for transition processes and total coordinated kills ($t(59) = .83, p = .410$; $t(59) = .73, p = .469$). Mean scores indicate that trained teams with no diversity score the highest in transition processes ($M = 3.51, SD = .98$), followed by teams with gender diversity and training ($M = 3.44, SD = 1.14$), untrained teams with gender diversity ($M = 2.67, SD = .69$), with untrained homogenous teams scoring the lowest on transition processes ($M = 2.19, SD = 1.15$). These mean

scores indicate that the true difference between groups on transition processes is not between untrained teams with or without gender diversity, but teams that have training or not.

Mean scores of coordinated kills suggest that trained teams with gender diversity scored the highest on coordinated kills ($M = 7.50$, $SD = 2.58$), followed by untrained teams with gender diversity ($M = 5.86$, $SD = 2.55$), trained homogenous teams ($M = 5.08$, $SD = 2.81$), with untrained homogenous teams scoring the lowest number of coordinated kills ($M = 4.86$, $SD = 1.95$). These mean scores are consistent with the results of Hypothesis 1b and previous research, which suggest there is a difference between groups with gender diversity and homogenous teams in team effectiveness.

The ANOVA revealed no significant difference between groups in action processes ($F = 2.33$, $p = .083$).

The results of this analysis suggest mixed results. However, the significant outcome variables, total team points, total team kills, team interaction accuracy, transition processes, and coordinated kills suggest that there is a difference between groups based on gender diversity and training. This is consistent with previous research and previous hypotheses (Hypothesis 1b).

Only one study variable, total team interaction accuracy, indicates support for Hypothesis 1c. Differences in total team interaction accuracy show that teams with gender diversity score higher than teams without gender diversity on some shared mental models compared to their counterparts in each training condition. These results indicate

support for this hypothesis, and previous research stating that teams with gender diversity will perform better than other teams.

Basis of Analysis for Hypotheses 2, 2a, 2b, and 2c: One Way ANOVA Results.

Results of Hypothesis 2, 2a, 2b, and 2c are based on the results of a one way ANOVA. The ANOVA compared eight groups categorized based on type of diversity (none, ethnic, gender, or both) and training. The variables testing team performance, shared mental models, and team behavioral processes were the dependent variables. Each hypothesis was tested using a specific contrast. However, it should be noted that further statistical analysis of individual categories was not possible given the small sample size of some groups.

Team Performance

Results of the ANOVA determined that both overall team performance variables (total team points and total team kills) revealed a significant difference between teams based on diversity and training ($F = 3.20, p = .006$; $F = 2.92, p = .011$). Means for total team points and total team kills are displayed in Table 9 below. Further analysis of the significant differences between groups are explored in the results sections of Hypotheses 2, 2a, 2b, and 2c.

Table 9: Mean Scores for Team Performance Variables based on Type of Diversity and Training

<u>Variable</u>	<u>Category</u>	<u>Mean</u>	<u>Standard Deviation</u>
Total Team Points	No Diversity, No Training	90.00	.
	Ethnic Diversity, No Training	81.67	35.45
	Gender Diversity, No Training	150.00	.
	Both Ethnic & Gender Diversity, No Training	91.67	41.19
	No Diversity, Training	53.33	32.15
	Ethnic Diversity, Training	95.00	42.49

	Gender Diversity, Training	150.00	16.90
	Both Ethnic & Gender Diversity, Training	115.00	42.30
	Total	108.10	43.51
Total Team Kills	No Diversity, No Training	30.00	.
	Ethnic Diversity, No Training	17.17	9.33
	Gender Diversity, No Training	55.00	.
	Both Ethnic & Gender Diversity, No Training	27.00	11.93
	No Diversity, Training	16.33	6.51
	Ethnic Diversity, Training	25.90	10.07
	Gender Diversity, Training	33.50	6.74
	Both Ethnic & Gender Diversity, Training	31.07	12.12
	Total	28.47	11.92

Shared Mental Models

Results of the ANOVA determined that team total interaction accuracy was significantly different between teams based on diversity type and training ($F = 2.72, p = .017$). Team total role accuracy was not significant ($F = 1.62, p = .149$). Mean scores for total interaction accuracy are displayed in Table 10. Further analysis of the significant differences between groups are explored in the results sections of Hypotheses 2, 2a, 2b, and 2c.

Table 10: Mean Scores for Significant Team Mental Model Variables based on Diversity Type and Training

Variable	Category	Mean	Standard Deviation
Total Mental	No Diversity, No Training	72.00	.
Model Interaction Accuracy	Ethnic Diversity, No Training	43.50	14.32
	Gender Diversity, No Training	56.00	.
	Both Ethnic & Gender Diversity, No Training	64.50	8.24
	No Diversity, Training	47.33	18.50
	Ethnic Diversity, Training	61.30	17.24
	Gender Diversity, Training	69.00	13.10
	Both Ethnic & Gender Diversity, Training	65.36	12.83
	Total	62.11	15.00

Team Behavioral Processes

Results of the ANOVA determined that team behavioral process variables differed in some contexts among teams based on diversity and training, but one did not: Transition processes revealed a significant difference amongst groups ($F = 2.80, p = .014$) and so did coordinated kills ($F = 3.59, p = .003$); action processes were not significantly different amongst teams with different types of diversity and presence of training ($F = 1.30, p = .266$). Mean scores for transition processes and coordinated kills are listed in Table 11. Further analysis of the significant differences between groups are explored in the results sections of Hypotheses 2, 2a, 2b, and 2c.

Table 11: Mean Scores for Team Behavioral Process Variables based on Type of Diversity and Training

Variable	Category	Mean	Standard Deviation
Average Transition Processes	No Diversity, No Training	4.67	.
	Ethnic Diversity, No Training	1.78	.40
	Gender Diversity, No Training	3.67	.
	Both Ethnic & Gender Diversity, No Training	2.50	.59
	No Diversity, Training	3.67	.88
	Ethnic Diversity, Training	3.47	1.04
	Gender Diversity, Training	3.63	1.10
	Both Ethnic & Gender Diversity, Training	3.38	1.17
	Total	3.23	1.14
Total Coordinated Kills	No Diversity, No Training	5.00	.
	Ethnic Diversity, No Training	4.83	2.14
	Gender Diversity, No Training	9.00	.
	Both Ethnic & Gender Diversity, No Training	5.33	2.34
	No Diversity, Training	3.00	1.73
	Ethnic Diversity, Training	5.70	2.83
	Gender Diversity, Training	9.38	1.06
	Both Ethnic & Gender Diversity, Training	6.96	2.65
	Total	6.52	2.76

Hypothesis 2: Organizational support (team training) will moderate diverse team performance; diverse teams with team training will be more effective than other teams.

To test Hypothesis 2, a contrast testing the difference between the Combined Diverse Teams with training (those with a presence of diversity, either ethnic, gender, or both ethnic and gender, who had training) compared to all other groups was performed. The results of this contrast revealed mixed results for differences in outcome variables between trained groups with diversity and all other groups.

Team Performance

The contrast revealed that total team points and total team kills were not significantly different when comparing Combined Diverse Teams with training to other teams ($t(55) = -1.87, p = .067$; $t(55) = -.214, p = .832$).

A series of contrasts comparing total team points and total team kills for specific diverse types with training to other groups were conducted. The results of these contrasts indicated teams with gender diversity and training ($M = 150.00, SD = 16.90$) differed significantly from ‘other groups’ on total team points ($M = 84.71, SD = 35.65$; $t(55) = -3.02, p = .004$). Teams with ethnic diversity ($t(55) = -.094, p = .925$) and teams with both ethnic and gender diversity ($t(55) = -1.48, p = .146$) did not differ significantly from other groups on team points. Specific means for total team points are listed in Table 12.

None of the specific Combined Diverse Teams with training differed significantly from other groups on total team kills; trained teams with ethnic diversity ($t(54) = .653, p = .517$), gender diversity ($t(54) = -.848, p = .400$), and both gender and ethnic diversity ($t(54) = -.483, p = .631$) were not significantly different from ‘other groups.’

Shared Mental Models

The contrast revealed that team total mental model interaction accuracy was not significant for the Combined Diverse Teams with Training when compared to other groups ($t(55) = -1.64, p = .108$). None of the specific Combined Diverse Teams with training differed significantly from other groups on team interaction accuracy; trained teams with ethnic diversity ($t(55) = -.742, p = .461$), gender diversity ($t(55) = -1.866, p = .067$), and both gender and ethnic diversity ($t(55) = -1.677, p = .099$) were not significantly different from ‘other groups.’

Team Behavioral Processes

The contrast determined that coordinated kills significantly differed between Combined Diverse Teams with training ($M = 7.11, SD = 2.74$) to all other groups ($M = 4.93, SD = 2.17; t(55) = -2.16, p = .035$). A series of contrasts comparing coordinated kills for specific diverse types with training to other groups were conducted. These results indicate that only teams with gender diversity and training ($M = 9.38, SD = 1.06$) significantly differed from ‘other teams’ on coordinated kills ($M = 4.93, SD = 2.17; t(55) = -3.37, p = .001$). Teams with ethnic diversity ($t(55) = -.241, p = .810$) and teams with both ethnic and gender diversity ($t(55) = -1.67, p = .101$) were not found to be significantly different from ‘other teams.’ Specific means for coordinated kills are listed in Table 12 and illustrated in Figure 10.

The contrast revealed that transition processes did not significantly differ between Combined Diverse Teams with training compared to other teams ($t(55) = -.653, p = .517$). None of the specific Combined Diverse Teams with training differed

significantly from other groups on transition processes; trained teams with ethnic diversity ($t(55) = -.447, p = .656$), gender diversity ($t(55) = -.739, p = .463$), and both gender and ethnic diversity ($t(55) = -.320, p = .750$) were not significantly different from ‘other groups.’

The results of this analysis suggest mixed results. The significant outcome variable, total coordinated kills, suggests that teams with diversity show more coordination when they have training as compared to other teams (either homogenous with training or teams with no training at all).

Table 12: Hypothesis 2: Mean Scores of Significant Outcome Variables for Training & Diversity Type

Outcome Variable	Contrast Group	Category	Mean Score	Standard Deviation	
Total Team Points	‘Other Teams’	No Diversity, No Training	90.00	.	
		Ethnic Diversity, No Training	81.67	35.45	
		Gender Diversity, No Training	150.00	.	
		Ethnic & Gender Diversity, No Training	91.67	41.19	
		No Diversity, Training	53.33	32.15	
		Total	84.71	35.65	
	Diverse Teams with Training	Diverse Teams with Training	Ethnic Diversity, Training	95.00	42.49
			Gender Diversity, Training	150.00*	16.90
			Ethnic & Gender Diversity, Training	115.00	42.30
			Total (Combined Diverse Teams with Training)	116.74	38.49
Total Coordinated Kills	‘Other Teams’	No Diversity, No Training	5.00	.	
		Ethnic Diversity, No Training	4.83	2.14	
		Gender Diversity, No Training	9.00	.	
		Ethnic & Gender Diversity, No Training	5.33	2.34	
		No Diversity, Training	3.00	1.73	
		Total	4.93	2.17	
	Diverse Teams with Training	Diverse Teams with Training	Ethnic Diversity, Training	5.70	2.83
			Gender Diversity, Training	9.38*	1.06
			Ethnic & Gender Diversity, Training	6.96	2.65
			Total (Combined Diverse Teams with Training)	7.11*	2.74

*Indicates means which a contrast found significantly different from total mean score of ‘Other Teams’ ($p < .05$).

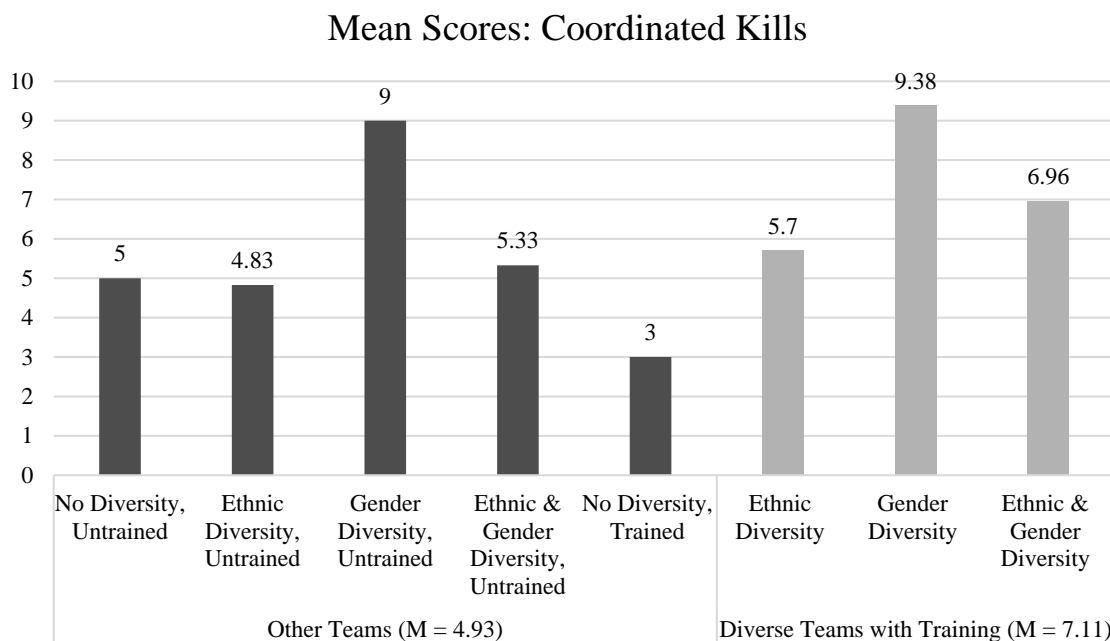


Figure 10: Mean scores for total coordinated kills based on type of diversity and training. Means for contrast groups are indicated in the axis label.

Hypothesis 2a: Diverse teams who received team training will have better shared mental models than homogenous teams with team training.

Hypothesis 2b: Diverse teams who received team training will have better team processes than homogenous teams with team training.

To test Hypothesis 2a and Hypothesis 2b, a contrast comparing shared mental models and behavioral processes of Combined Diverse Teams who received training to those who received training and had no diversity was performed. This contrast was performed based on the results of the previously conducted one way ANOVA which compared teams based on diversity type and training. Significant outcome variables from the results of that ANOVA were the only variables that were assessed.

Shared Mental Models

Results of the contrast determined that interaction accuracy of shared mental models for teams were significantly different between Combined Diverse Teams with training (ethnic, gender, and both ethnic and gender) and homogenous groups with training. Total mental models of team interaction accuracy was significant ($t(55) = 2.16, p = .035$), indicating that of teams with training, Combined Diverse Teams with training have better mental models ($M = 65.11, SD = 14.02$) than those without diversity ($M = 47.33, SD = 18.50$). A series of contrasts comparing team interaction accuracy for specific diverse types with training to homogenous groups with training were conducted. The results of these contrasts indicated teams with gender diversity and training ($M = 69.00, SD = 13.10$) differed significantly from homogenous groups and training ($M = 47.33, SD = 18.50$) on team interaction accuracy ($t(55) = 2.33, p = .023$). Similarly, trained teams with gender and ethnic diversity ($M = 65.36, SD = 12.83$) differed significantly from homogenous teams with training on team interaction accuracy ($M = 47.33, SD = 18.50; t(55) = 2.16, p = .035$). Trained teams with ethnic diversity ($M = 61.30, SD = 17.24$) did not significantly differ from teams with homogenous teams with training ($M = 47.33, SD = 18.50; t(55) = 1.55, p = .128$).

The results of this contrast indicate mixed support for Hypothesis 2a. For the significant outcome variable, total team interaction accuracy, diverse teams with training consistently outperform homogenous teams with training. Mean scores for total team interaction accuracy are detailed in Table 13 and illustrated in Figure 11.

Table 13: Hypothesis 2a: Mean Scores for Significant Mental Model Variables for Trained Teams by Diversity Type

Outcome Variables	Contrast Group	Category	Mean Score	Standard Deviation
Total Team Interaction Accuracy	No Diversity	No Diversity	47.33	18.50
	Diversity	Ethnic Diversity	61.30	17.24
		Gender Diversity	69.00*	13.10
		Ethnic & Gender Diversity	65.36*	12.83
		Total	65.11*	14.02

*Indicates means which a contrast found significantly different from teams with 'no diversity, training' ($p < .05$).

Mean Scores: Team Interaction Accuracy for Trained Teams

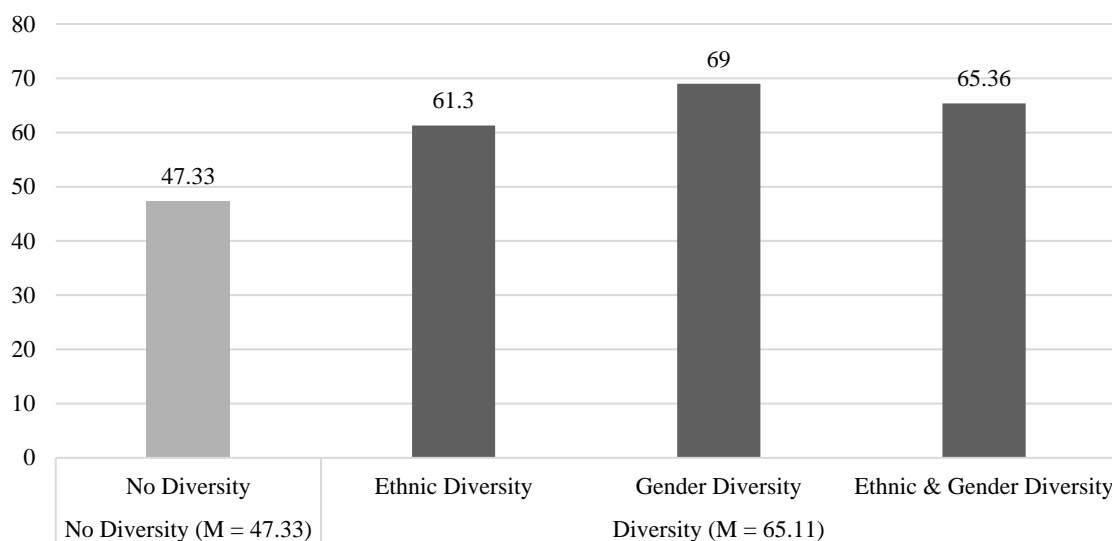


Figure 11: Mean scores for total team interaction accuracy in trained teams based on type of diversity. Means for contrast groups are indicated in the axis label.

Team Behavioral Processes

Results of the contrast were also used to determine support for Hypothesis 2b, which focused on team behavioral processes. The contrast revealed a significant difference between Combined Diverse Teams with training ($M = 7.11$, $SD = 2.74$) and trained homogenous groups ($M = 3.00$, $SD = 1.73$) for coordinated kills ($t(55) = 2.97$, p

= .004). A series of contrasts comparing coordinated kills for specific diverse team types with training to homogenous groups with training were conducted. The results of these contrasts indicated teams with gender diversity and training ($M = 9.38, SD = 1.06$) scored significantly higher than homogenous groups with training on coordinated kills ($t(55) = 3.87, p < .001$). Similarly, trained teams with gender and ethnic diversity ($M = 6.96, SD = 2.65$) differed significantly from homogenous teams with training on coordinated kills ($t(55) = 2.68, p = .010$). Trained teams with ethnic diversity ($M = 5.70, SD = 2.83$) did not significantly differ from homogenous teams with training on coordinated kills ($t(55) = 1.69, p = .097$).

The results of the contrast indicated that average transition processes were not significantly different for Combined Diverse Teams with training and homogenous teams with training ($t(55) = -.281, p = .780$). None of the specific Combined Diverse Teams with training differed significantly from homogenous groups on average transition processes; trained teams with ethnic diversity ($t(55) = -.293, p = .771$), gender diversity ($t(55) = -.059, p = .953$), and both gender and ethnic diversity ($t(55) = -.453, p = .652$) were not significantly different from homogenous teams with training for transition processes.

The results of this analysis indicate mixed results for Hypothesis 2b, but do suggest that teams with diversity outperform homogenous teams on coordination when trained. Mean scores for the significant outcome variable (coordinated kills) are recorded in Table 14.

Table 14: Hypothesis 2b: Mean Scores for Significant Behavioral Processes for Trained Teams by Diversity Type

Outcome Variables	Contrast		Mean	
	Group	Category	Score	Standard Deviation

Total Coordinated Kills	No Diversity	No Diversity	3.00	1.73
	Diversity	Ethnic Diversity		5.70
		Gender Diversity	9.38*	1.06
		Ethnic & Gender Diversity	6.96*	2.65
		Total (Combined Diverse Teams with Training)	7.11*	2.74

*Indicates means which a contrast found significantly different from teams with 'no diversity, training' ($p < .05$).

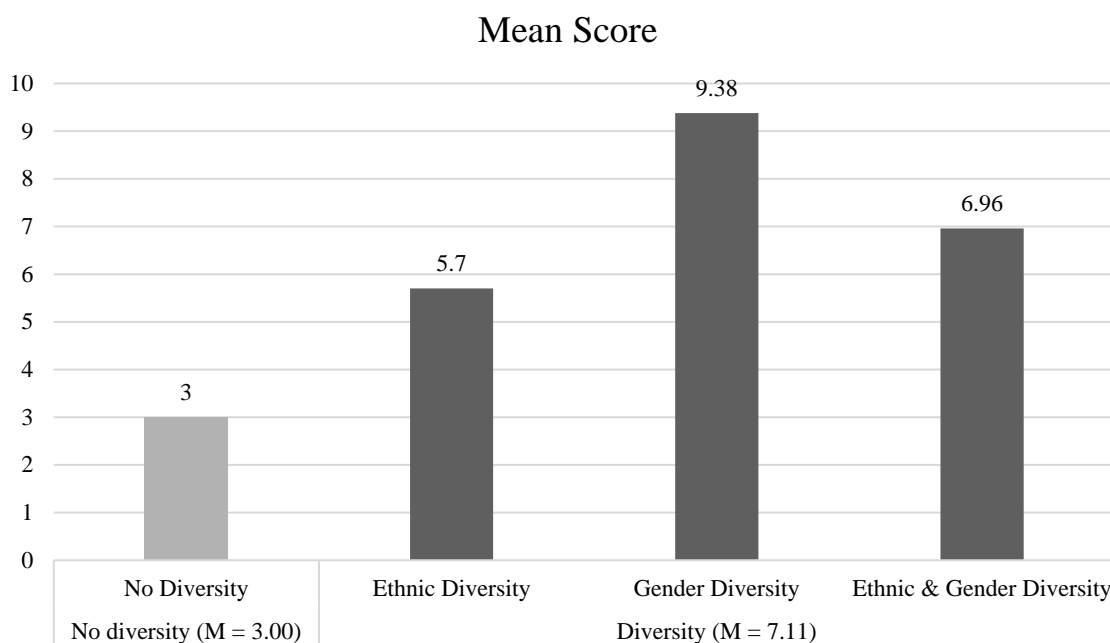


Figure 12: Mean scores for total coordinated kills of teams *with training* based on diversity type. Means for contrast groups are indicated in the axis label.

Hypothesis 2c: Diverse teams with team training will be more effective than diverse teams without training.

A contrast was conducted to compare Combined Diverse Teams with training to Combined Diverse Teams without training based on the results of the previously conducted one way ANOVA.

Further analyses comparing specific types of diversity in teams based on training was unable to be conducted due to small sample sizes in diversity types for teams who did not receive training.

Team Performance

Results of the contrast indicate that performance scores, total team points and total team kills, were not significantly different for the groups compared ($t(55) = .746, p = .459$; $t(55) = -.638, p = .526$).

Shared Mental Models

Results of the contrast indicate that team interaction accuracy was not significantly different for diverse groups with training compared to those without ($t(55) = 1.83, p = .073$).

Team Behavioral Processes

Results of the contrast indicate that transition processes were not significantly different for diverse teams with training compared to those without training, and neither were coordinated kills ($t(55) = 1.93, p = .059$; $t(55) = .936, p = .353$). The results of this analysis indicate that training did not significantly improve diverse team performance or processes.

Summary of Results

Team Performance

Results of this study indicate teams with diversity score higher on team points than homogenous teams. Combined Diverse Teams outperformed homogenous teams on team points, as did teams with gender diversity and teams with ethnic and gender

diversity. Teams with gender diversity score significantly better than homogenous teams on team kills. In comparison to other types of diversity, teams with gender diversity outperform teams without gender diversity on both team points and team kills. When comparing team performance based on diversity type and training, there is a difference among groups; results indicate that teams within the ‘gender diversity and training’ category outperform all other groups.

Shared Mental Models

Results of this study indicate that shared mental models differ amongst teams based on diversity on interaction accuracy, but not for role accuracy. When comparing homogenous teams to Combined Diversity Teams, there is not a significant difference amongst teams for team interaction accuracy. However, results indicate that teams with gender diversity have significantly better team interaction accuracy mental models than teams without gender diversity. Additionally, untrained teams with gender diversity performed significantly better than their untrained counterparts with no gender diversity on team interaction accuracy. ANOVA results indicate that teams differed on team interaction accuracy based on type of diversity and team training. Of trained teams, teams with gender diversity as well as teams with ethnic and gender diversity outperformed homogenous teams with training on team interaction accuracy mental models.

Team Behavioral Processes

Results of this study indicate that teams with diversity tend to outscore homogenous teams on coordinated kills. Combined Diverse Teams, as well as team with gender diversity and teams with ethnic and gender diversity outscored homogenous teams

on number of coordinated kills. Teams with gender diversity had significantly more coordinated kills than teams without gender diversity. Training influenced coordinated kills; results indicate that Combined Diverse Teams with training outscore other teams for coordinated kills, as did teams with gender diversity and training and teams with ethnic and gender diversity and training.

Differences among teams based on diversity type for transition processes varied, but a key finding indicates that teams with ethnic diversity outperform homogenous teams with training on average transition processes.

Discussion

This study adds to the growing literature on diversity in teams, team effectiveness, and the moderating effect of organizational support on diverse team outcomes. Future research should continue to examine the extent to which training and diversity of members can contribute both uniquely and jointly to performance outcomes for teams.

Key Findings

Diverse Team Outcomes

The results of this study suggest that teams with diversity (ethnic and/or gender) perform better on total team points than homogenous teams. Specifically, the results of this study indicate that teams with gender diversity significantly outperformed other teams on total team points, total team kills, total team interaction accuracy, average transition processes, and coordinated kills, regardless of training. These results are consistent with the literature on gender diversity, which show that teams with gender diversity perform better than homogenous teams for most outcomes.

Results of this study also suggest that ethnically diverse teams outperformed other teams on transition processes, regardless of training. These results add to the mixed findings on ethnically diverse team effectiveness, suggesting that ethnically diverse teams are more effective at planning/strategizing than other teams. These results also highlight a need for more research on ethnically diverse teams, looking specifically at team behavioral processes.

Training & Diverse Team Outcomes

The results of this study suggest the need for more research on the impact of team training for heterogeneous teams. Findings of this study determined that Combined Diverse Teams performed better on coordinated kills and team interaction accuracy, key issues that previous research suggests teams with high amounts of surface-level diversity struggle with. These results imply that when trained, diverse teams are more effective than homogeneous teams in mental model interaction accuracy and coordination.

This study suggests that team training positively impacts diverse teams, indicating that organizational support, in the form of team training, is an important intervention for improving diverse team performance. This is especially true to improve team effectiveness in areas that teams with surface-level diversity have traditionally struggled with: team interaction accuracy, team transition processes, and coordination.

Additionally, teams with diversity consistently outperformed homogeneous teams on basic measures of performance, total team points and total team kills. These results are consistent with the informational diversity-cognitive resource perspective, which claims that team with diversity will perform better than homogeneous teams. These results

indicate that diversity is an important, positive variable to consider when hoping to improve team performance.

While many of the team effectiveness variables analyzed in this study indicated significant results, not all variables were significantly different. Two variables, average action processes and total role/team accuracy mental models, determined there were no significant differences among groups on any of the analyses. This lack of significance between different types of diversity may indicate something important as well: Teams with gender and/or ethnic diversity do not perform significantly different than homogenous teams, and thus these surface-level attributes do not inhibit performance as some previous research suggests.

Limitations

This study faces several limitations. To start, the study uses archival data with a limited sample size. While the use of this dataset allowed for the analysis of multiple complex variables, the archival study was not designed to analyze data related to surface level diversity. This resulted in an uneven number of groups, with two groups (gender diversity, no training and no diversity, no training) only had one team in each category. However, most of the hypotheses looked at groups through the results of contrasts, meaning categories are grouped together to form larger groups for the analysis (eg. when comparing groups with training and diversity to all others, groups are combined to form two larger categories). It should also be noted that a Levine's test for equality of variance was performed for each analysis and determine that variance between group that were contrasted were equal in variance in each case.

In addition, the archival study was conducted at a university in a very ethnically diverse area. Because all participants were from the same university community, it is impossible to determine whether participants knew each other before the study or the extent to which their prior experiences interacting with diverse others may have influenced their interpersonal interactions. This is a limitation because research shows that team tenure impacts team outcomes, especially in the context of heterogeneous teams.

On top of this, only gender and ethnic diversity were assessed as diverse variables. These two variables are important surface level attributes, but they are by no means generalizable to other attributes. Additionally, the way the two variables were studied in this analysis is also a limitation. Gender was only examined as man/woman, and ethnicity was lumped into white/not white categories. These categories, especially in the political zeitgeist of 2020, are not enough when studying diversity variables. We now identify gender on a spectrum, not simply as a categorical variable; something this data set was unable to identify. Additionally, to get the best results it would be best to identify specific types of ethnic diversity within teams, rather than simply coding teams as all white or ethnically diverse; different ethnicities (as a group) may impact team effectiveness differently. This is something the current study was unable to address given the limitations of the dataset.

Future Research

This study sheds light on a host of areas in need of future research related to diverse teams, team effectiveness, and the impact team training has on diverse team outcomes.

First, it's important to note that processes were looked at on average in this analysis (in addition to an analysis specific to coordination). However, we know that different processes make up each specific category; there were three transition processes and four action processes involved in the archival study, and many more included in the broader literature. The number of significant differences found in "coordinated kills" indicate that team diversity may impact some team processes more than others, suggesting this is an important area to consider for future research. Looking at the results of specific processes rather than the average score each team received may be more effective in identifying ways diverse team outcomes are impacted by training.

Second, there is also a need for more research on individual surface level diversity variables. Factors that are important to consider in future research include age, religious dress/religion, and physical disability, among others. Additionally, future research should look at gender and ethnicity on a deeper level. For example, it would be beneficial to look at gender as a spectrum, rather than simply man or woman. Additionally, looking at the distribution of specific ethnicities rather than simply "ethnically diverse" (not homogenously white) teams would be not only beneficial, but also a more holistic, modern way to research ethnic diversity in teams.

Finally, future research should look at the effectiveness of diversity trainings in comparison to team training. Currently, many corporations are investing in diversity training as a popular intervention used to promote inclusion (and thus team cohesion and effectiveness) in the workplace. However, little research has been conducted on the impact these trainings have on team outcomes. Future research should seek to identify

first the impact of these diversity trainings on team outcomes, and next compare the impact of diversity trainings on team outcomes to the impact of team training on diverse teams. Currently, results of this study suggest that team training may be a viable alternative option for organizations looking to support diverse teams, particularly in transition processes, team interaction mental models, and coordination.

Conclusion

The results of this study indicate a need for more research on the impact team training has for heterogenous team outcomes. Researchers should work to further identify the impact of team training, and other forms of organizational support on teams with high levels of surface level diversity.

Results also indicate that teams with gender and/or ethnic diversity that receive training outperform homogenous teams on transition processes, interaction accuracy mental models, and coordination. It's important to note that these variables focus on a team's ability to effectively work together through activities like planning, evaluating, communicating, and coordinating. Given these results, team training (specifically interpositional and interactional training) is a viable option for organizations hoping to improve the effectiveness of teams with ethnic and/or gender diversity in these areas.

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