

Cognitive Ability and Personality Can Predict Team Productivity but Not Team Synergy

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Our goal with this study was to evaluate individual characteristics that would be potentially predictive of team success. We examined the Big Five factors of agreeableness and conscientiousness, general cognitive ability, and teamwork aptitude. The Big Five factors and general cognitive ability predicted team productivity but not synergy or satisfaction.

Despite a burgeoning literature on teams and teamwork, scholars have not yet thoroughly examined the *selection* of individuals for forming teams. (McClough & Rogelberg, 2003). To form an effective team, we believe it is critical to identify individuals' aptitudes that improve team performance, and determine how to apply those aptitudes to select team members. In this study, we focused on general cognitive ability, the specific cognitive ability of teamwork aptitude, and personality as predictors of team effectiveness as represented by unit (team) level productivity and satisfaction with the team.

General Cognitive Ability

Meta analyses have shown the power of cognitive ability in predicting job performance. In their meta analysis, Hunter and Hunter (1984) found that the mean validity of cognitive ability ranged from 0.27 to 0.61, across many kinds of job families. Historically then, a positive relationship between cognitive ability and task performance has been well established. This link is not as well established in teams at the team level. A meta analysis by Devine and Phillips (2001) suggested that cognitive ability measured at the team level was related to team performance ($r = .29$). Therefore, we will include general cognitive ability as a predictor of team performance.

Teamwork Knowledge, Skill, and Ability

In comparing teamwork to individual work, working in a team environment obviously requires additional competencies. In general, interpersonal skills—and knowing when to apply them—are very important. When individuals are working in individual-based environments, a lack of

interpersonal skills is less consequential when compared with individuals working in a team-based environment (Lawler, 1986).

Stevens and Campion (1994) identified a set of KSAs necessary for the teamwork environment. They focused on an individual level of appropriate behavior and created a test to measure them as KSAs. They identified two major categories of Teamwork KSAs (interpersonal KSAs and Self-management-KSAs) with five sub-categories (e.g. conflict resolution KSAs, communication KSAs, and planning and task coordination KSAs).

Several previous studies have demonstrated that using the Teamwork KSAs can improve team performance. In addition to Stevens and Campion (1994, 1999), McClough and Rogelberg (2003) used the Teamwork KSA test as a selection measure for team composition. Their study indicated that individuals who scored higher on the Teamwork KSA tests, tended to receive higher ratings from external raters and peers on performing the task of developing a new project. We wanted to determine if adding TKSAs would add incremental predictability beyond general mental ability to team performance

What Factors of Individuals Influence These Behaviors?

One set of characteristics, which influence individuals' behaviors, is personality. The Big-Five personality typology has traditionally labeled these five factors: extraversion, agreeableness, conscientiousness, emotional stability, and openness (Goldberg, 1990). The emergence of the Big-Five personality typology has triggered considerable interest in the role of the personality in the work place because of the abundance of empirical

research (Robertson & Callinan, 1998). Personality characteristics have been identified as a potentially useful selection variable in the determination of optimal team composition (Kichuk & Wiesner, 1998; Peeters, VanTuijl, Rutte, & Reymen, 2006). Only a handful of studies have examined the relationships between the big five personality factors and objective team performance (Kichuk & Wiesner, 1998; Neuman & Wright, 1999). Kichuk and Wiesner (1998) found that successful teams were characterized by higher levels of extraversion and agreeableness and lower levels of neuroticism than unsuccessful teams. Neuman, Wagner, and Christiansen (1999) found that high performing teams were collectively high in conscientiousness, agreeableness, and had the greatest differences in extraversion and emotional stability. That is, the teams that performed best were composed of individuals who were high in conscientiousness and agreeableness, but included both extroverts and introverts as well as a range of emotional stability. These results indicated that as with individual performance, conscientiousness—planning, attention to detail—pays off in teams. Also, agreeable people are better at cooperating, another plus for working in a team setting. These results reinforce the importance of personality characteristics for team member selection.

Previous studies also support that the Big-Five personality influences several job attitudes, including job satisfaction. For example, Cropanzano, James, and Konovsky (1993) examined the influence of negative and positive dispositions on job satisfaction. They expected and found significant correlations between these variables since these dispositional characteristics relate to individuals' emotional reactions toward environmental events that generate job satisfaction. Therefore, it is also expected that personality would have a positive influence on job satisfaction of team members.

Teams: Effectiveness: Productivity, Synergy, and Satisfaction

An effective group can generate better outcomes when compared with the labor, time, or cost of an individual. The term “productivity” typically means how many products a team can generate. Team synergy is “the idea that the team’s output exceeds the sum of the outputs that would have been

produced by the members of the team when employed outside of the team” (Rose, 2000, p. 375). Alchian and Demsetz (1972) specified team outcomes as “marginal products,” which use several sources of input, yield an output larger than just a sum of individual outcomes, and not all team products belong to individuals. The concept of synergy can also be articulated as a numerical formula, such as $f(A) + f(B) < f(A+B)$ (Alchian & Demsetz, 1972; Rose, 2000).

Satisfaction with the Team as Outcome

The effectiveness of the team is of considerable interest to organizations as the synergetic effect of teams is one of the appeals of the teamwork model (Rose, 2000). Satisfaction with the team is frequently studied as a process related to team success and may take the form of satisfaction with other members, team rewards or the perceived success of the team. Finally, individuals working with effective groups tend to have higher overall job satisfaction (Gladstein, 1984).

Hypotheses

Based on previous research, we predicted that teams with greater cognitive ability would, as a collective, demonstrate greater productivity (i.e., in this case, produce more correct answers on a NASA exercise) and would generate more synergy. We also hypothesized that the collective Teamwork KSA team score would predict the team productivity (again, NASA team score) as well as more satisfaction with the team. Finally, we predicted that higher levels of agreeableness and conscientiousness would relate to more satisfaction with the team.

METHOD

Participants

A total of 177 participants grouped into 59 teams, participated in the experiment. They were students at California State University, San Bernardino (CSUSB) enrolled in undergraduate psychology classes. No conditions were set for participants to volunteer for this study. Among the 177 participants, members of 12 teams did not follow instructions to complete the exercises, and thus 12 teams were dropped from further analysis. Specifically, data from five teams were dropped

from further analysis because one team member left the experiment in the middle of the exercise, and data from seven groups were dropped from further data analysis when one of each group's members did not complete the NASA task as directed. These teams evaluated two items as of equal importance instead of rank ordering the 15 items from 1 to 15. Therefore, data from 141 participants or 47 teams remained for analysis.

Procedures

Recruiting Participants. Participants were recruited from upper division psychology classes at CSUSB. Participants were informed about the experiment from psychology professors and a communication board located near the psychology department office. Participants were asked to sign up for a scheduled time in the performance assessment laboratory. When three group members had registered for a given time, they were contacted by the experimenter to confirm their intended participation in the experiment. The experiment schedule was confirmed by telephone or e-mail.

Surveys and Individual Task. After all registered participants appeared at the performance assessment laboratory, the procedures of the experiment were explained to them. First of all, participants were asked to complete an informed consent and a demographic data survey. Then, each participant completed online the Wonderlic Personnel Test, a general cognitive test. The test was timed; once the participant began, the test had to be completed within 12 minutes. As a second phase of the experiment, individuals independently completed the NASA moon survival exercise. Then, the three participants composing a team were asked to move to a smaller room to complete the same NASA moon survival exercise as a team. Before they started working on the team task, the experimenter collected each participant's answer sheet of the survival task.

Conducting a Group Task. Participants as a team received instruction on the NASA moon survival exercise from the researcher. Then, participants discussed with their team the survival exercise and created a final listing to be turned in to the experimenter.

Completing Follow-up Survey. After completing the NASA team task, participants were asked to complete a satisfaction survey assessing their work

as a team. As each team member completed the survey, he or she left the experimental laboratory.

Individual and Group Task. Participants as both an individual and team completed the NASA moon Survival Exercise that was adapted from Hall and Watson (1970). The task requires participants to rank order 15 items according to their importance to survive a 200-mile cross-country trek on the Moon. The correct ranking of the 15 items has been determined by subject matter experts from the Crew Equipment Research Section of the NASA Manned Spacecraft Center at Houston, Texas (Hall & Watson, 1970).

The NASA survival task was adopted for this study for three reasons. First, the exercise is an intellectual task in which participants need to make their own judgments (Inanami, 1994). These characteristics of the task create opportunities for a team to create team process. Second, this task has been employed extensively in small group studies and the results can be compared among groups (Inanami, 1994). Interjudge reliability of experts' rankings has been found to be .82 (Hall & Watson, 1970). Finally, a comparison of the individual and group outcomes from this task will allow us to evaluate the existence of synergy.

Scoring the NASA Survival Task. The quality of the team's performance was evaluated by the sum of differences between a team ranking and correct answer for each item. The final score was indicated by a difference score that could range from 0 to 112 (0 representing no discrepancy in the rankings when compared with the expert rankings and 112 representing the maximum discrepancy possible). The smaller number indicates better team performance, since it indicates that the team product is similar to the correct answers. On the other hand, a large number indicates poor team performance since the team product is so different from the correct answer (see Table 1).

Calculating Synergy. The comparison of the sum of the individual outcomes for the members of a team and that team's outcome permits a quantitative estimate of how much synergy was created by the team relative to the performance of the individuals within the team. More specifically, the team's final ranking difference score was subtracted from the mean discrepancies in rankings of the individual team members (see Table 2). A high number indicates more synergy. For example,

a team composed of individuals whose discrepancy scores are relatively high but whose team achieves a low score for the team exercise is demonstrating considerable synergy; the discrepancy between the sum of the individual scores and the team score would be in the positive direction. In contrast, for a team in which the individual members' discrepancy scores are relatively low but whose team achieves a relative high discrepancy score for the team exercise are demonstrating negative synergy or process loss, and their resulting score will be negative.

Measures

General Cognitive Ability. The Wonderlic Personnel Test (WPT) was used for measuring general cognitive ability. The WPT is a short measure of cognitive ability including a total of 50 items. These items presented a variety of content, such as vocabulary, sentence arrangement, sentence parallelism, number series, analysis of geometric figures, logic, arithmetic problem-solving, and interpretation of proverbs. The test has been validated against a wide variety of measures and criteria. For example, the WPT has been employed in a number of industries to make hiring decisions. The reliability of WPT is relatively high. The WPT manual reports test-retest reliabilities ranging from .82 to .94, and alternate-form reliability ranging from .73 to .95. For this study, the WPT was administered online.

Teamwork Knowledge, Skill, and Ability. The Teamwork Knowledge Skill and Ability Test (Stevens & Campion, 1994) was used to assess participants' interpersonal KSA including conflict resolution, collaborative problem solving, and communication KSA, and self-management KSA including goal setting and performance management, and planning and task coordination KSA. The test includes 35 multiple choice situational judgment items. Participants were asked to choose one best answer for each item. Subscale scores are computed as well as a total score. The correct answers were summed to create a total Teamwork KSA score; therefore, a test score can range from 0 to 35. The KSA has been used to predict success in work settings that require cooperation. Criterion validation studies of the measure have been conducted by the authors of the scale (Stevens & Campion, 1999). Alpha reliability

for the overall composite was .65 for this study. Scores of each subscale were summed to obtain a composite score, and the composite score was utilized for testing hypotheses. Stevens and Campion (1999), the developers of the Teamwork KSA used a composite test score in their research and treated the composite as a measure of teamwork aptitude, which is the intended use for this study.

Big Five Personality. The 40-item Mini-Marker set (Saucier, 1994) was used for measuring Big-Five personality, which is composed of extraversion, agreeableness, conscientiousness, emotional stability, and intellect/openness. The Mini-Marker set is a subset of Goldberg's (1992) set of unipolar 100 adjective markers for Big-Five personality. Among these 100 items, eight adjectives for each Big-Five dimension had been identified through factor analysis. Participants were asked to choose a number, which indicated how accurately each adjective describes them. This measure has been shown to have adequate psychometric properties. Coefficient alpha for extraversion was .79, agreeableness was .76, conscientiousness was .80, emotional stability was .71, and intellect/openness was .69 for this study. We treated the score of each personality dimension as a continuous variable. Individuals who scored higher on certain dimension are assumed to express stronger personality than individuals who score lower on the dimension. For the further analysis, conscientiousness and agreeableness scores were summed to obtain a combined score. This combined score indicated that individuals who scored higher on the combined score were assumed to possess stronger conscientiousness and agreeableness.

In addition to the previous predictor measures, team outcomes were evaluated by three dimensions: productivity, synergy, and individuals' satisfaction with their teams.

Productivity. Productivity was measured by using team scores of the NASA survival game. The criterion for productivity was measured by how closely the team's consensual rankings (i.e., those made by the team) mirrored the rankings as determined by NASA professionals.

Synergy. Synergy was measured by comparing individual and team scores. As previously mentioned, compared with individuals, teams should provide better outcomes and should have less discrepancy as a whole with the correct answers

than the individual. The team outcomes gain benefit from the combination of individual abilities as teams through the team process; however, it is possible that some teams would experience process loss and in fact do worse than their average individual NASA ratings would indicate. In this study, a team score and the average score of individuals within the team were compared to determine if teams experienced synergy or process loss. See Table 2 for examples.

Satisfaction. Three types of satisfaction measures were employed to assess satisfaction of team members after they completed the team task: A mutual satisfaction measure modified from Smith and Barclay (1997), a team satisfaction survey from Gladstein (1984) and a general satisfaction and two specific satisfaction measures from Hackman and Oldham (1980). Smith and Barclay's (1997) mutual satisfaction measure was originally developed to assess the satisfaction of the relationship between selling partners. Smith and Barclay defined mutual satisfaction as "the extent to which both partners in a relationship are satisfied and it reflects both the degree and congruence of partner evaluations" (p. 5). Composite reliability (internal consistency) was .81 for this study. These 6 items are self report Likert-type scales (1=strongly disagree, 7=strongly agree).

Three team satisfaction items were adapted from Gladstein (1984). The measure, which consists of self report Likert-type items (1=strongly disagree, 5=strongly agree), originally was used to measure the satisfaction with being a team member in the work place. The coefficient alpha was .73 for this study.

Measures of general job satisfaction, internal work motivation, and satisfaction for coworkers were adapted from Hackman and Oldham (1980). Three items of general job satisfaction assessed a group members' overall satisfaction with their team members. The original general satisfaction scale of Hackman and Oldham had five items. However, for this research purpose, two items, "I frequently think of quitting this job" and "People on this job often think of quitting," were eliminated, since the items might not be appropriate for measuring satisfaction for a short term group task. The coefficient alpha of all five items has been reported as .76 (Hackman & Oldham, 1975). For this study, the three-item measurement of general satisfaction yielded a .75

coefficient alpha. Six items of internal work motivation assessed a degree to which the employees' positive internal feelings when working effectively on the job, and negative internal feelings when doing poorly. The alpha of the items was .52 for this study. Another three items measured the satisfaction with co-workers. The alpha of all three items was .73 for this study. To modify the original measure for this research purpose, the term "job" and "work" were changed to "group task."

Scores from these five adapted subscales were summed to obtain one composite score to evaluate multiple dimensions of participants' perception of team satisfaction. A principal component analysis had indicated that the items from these subscales loaded on one component and accounted for 41% of total variance among the 20 items.

This study utilized satisfaction as a team outcome. Because this study measured satisfaction by individual participants' ratings of satisfaction but satisfaction was also to be used as a team level variable, it was important to ascertain that raters had a certain level of agreement within their team. To assess whether the participants of this study perceived the questions in agreement, an estimate of interrater reliability (r_{WG}) was calculated for the five subscales of satisfaction for all 43 teams (James, Demaree, & Wolf, 1984). Across all the satisfaction subscales the r_{WG} for the 43 groups was high. Average r_{WG} for all groups was .88. (See Table 3 for further information regarding r_{WG} of each subscale.)

RESULTS

Data Screening

Prior to the analysis, data cleaning and screening were conducted. No variables included more than five percent of missing data. Normality of the distributions was examined for each composed score by using an absolute value z of 3.3 for skewness and kurtosis. Agreeableness and openness from Big-Five personality, general satisfaction, and team satisfaction indicated significant skewness and kurtosis. Distribution of the variable agreeableness (Big-Five personality) indicated z for skewness as -5.20 and z for kurtosis as 3.50; distribution of openness (Big-Five personality) indicated z for skewness as -5.40, and z for kurtosis as 4.46; distribution of general satisfaction indicated z for skewness as -4.15; and

finally, the distribution of team satisfaction indicated z for skewness as 5.13. To investigate the factors causing the non-normal distributions, univariate and multivariate outliers were examined. Five univariate outliers from 4 teams were identified and these four teams were eliminated from further analysis. As a result of the elimination of these 12 participants, all the other composite measures were normally distributed, except for agreeableness ($z = -3.95$ $p < .001$) and team satisfaction ($z = 5.26$ $p < .001$). Although these two variables were skewed, no transformations were done and no more cases were eliminated. The removal of the four teams and 12 participants left a total of 129 responses from 43 teams which were further analyzed. The means and standard deviations of study variables for 129 respondents with 43 teams are reported in Table 4.

Correlational Analyses

Team cognitive ability (measured as the average Wonderlic score of the team) predicted team productivity as assessed with the NASA team score ($r = -.35$) but not team synergy, nor team satisfaction. Team conscientiousness and agreeableness predicted team productivity ($r = .39$) but not team synergy or satisfaction. Surprisingly, teamwork aptitude (TKSA) did not predict team productivity, synergy, or satisfaction. See Table 5.

We conducted follow up regression analyses to address whether adding the TKSA or the aggregated personality dimensions to general cognitive ability would explain additional variance in team performance or synergy. Although the composite personality variable of conscientiousness and agreeableness did predict team performance, it did not add significant variance when added after general cognitive ability. Further, the composite personality dimension with general cognitive ability did not predict incrementally synergy. Finally, as the bivariate correlations suggest, TKSA did not contribute additional variance to the prediction of team performance, nor synergy.

An unexpected finding was that satisfaction with the team was negatively related to team “synergy” ($r = -.36$), thus indicating that teams with high satisfaction with the team process did more poorly as a team than the individuals within that team on the NASA task. In an attempt to explain this finding, we correlated the individual

satisfaction subscales with synergy. Those results are in Table 6. Of the six subscales, four are statistically, negatively correlated with synergy, and two are nonsignificant. The two non significant correlations, were those that most directly address one’s team members.

Evidence for Synergy. As noted in Table 4, the mean NASA survival game scores of 43 teams was 43.12 and that of 129 individuals was 52.28. A t -test of these means indicated a significant difference, $t(170) = 4.41$, $p < .001$. The team NASA scores were significantly better than the mean of the individual NASA scores. Therefore, there was synergy based on simple means of outcomes and t -test, but this process gain was not predicted by any of the predictors used.

DISCUSSION

Throughout the long history of psychology, individuals’ behavior in group settings has been an interest for scholars. More recently, the popularity of implementing teams as a business strategy has kindled additional interest in studying teams. There have not been many studies regarding how best to select team members. Therefore, with this study, we explored what combination of individual characteristics could compose effective teams.

With this study, we defined a team as a set of people who are expected to create synergy which is “the idea that the team’s output exceeds the sum of the outputs that would have been produced by the members of the team when employed outside of the team” (Rose, 2000, p. 375). Therefore, a team is not just a gathering of people. A team should exhibit productivity that is greater than the sum of individual productivities. In fact, synergy was created by most of the teams in this study. The mean scores of the teams were greater than the scores generated by the individuals who composed the teams.

Furthermore, for this study, the ability of a team to produce team productivity which exceeded the sum of individuals’ productivities was considered team effectiveness. There are several factors that can positively influence team effectiveness. Among those factors, we focused on specific factors expected to influence team process. To identify competencies for forming an effective team, we focused on certain factors that within the context of

teamwork would facilitate better team process and improve team effectiveness. Specifically, the initial goal of this study was to examine the influence of individuals' characteristics on team level performance when they are team members.

Teamwork KSA did not predict team productivity at the team aggregated level of analysis. The constructs of Teamwork KSA are similar to well-established constructive behaviors and management skills; therefore, it was reasonable to expect the positive relationship between Teamwork KSA and team productivity. In addition, the positive role of cognitive ability on individual performance and team productivity has been well recognized. Unfortunately, although cognitive ability significantly positively predicted team productivity, Teamwork KSA did not.

The correlational analysis between synergy and the five subscales of satisfaction at the team aggregated level demonstrated that all the satisfaction subscales were significantly positively correlated with each other. Therefore, the analysis indicated that participants who were satisfied with their teams' working relationships did not demonstrate higher team level performances, but lower performance. This result suggests that these participants might not have focused on performing on the team task, but on building good working relationships with their team members. The correlations of the subscales with synergy support this supposition as the nonsignificant correlations with synergy arose from the subscales that most directly assessed the relationships with team members (e.g., "I am pleased with the way my colleagues and I work together" (Team satisfaction item) and "The chance to get to know the group members while on the group task" from the group member satisfaction scale which asked: How satisfied are you with this aspect of your group work?

The results of the correlational analysis cannot provide more than fuel for speculation, but there might have been important group dynamics throughout the laboratory experiment that paper and pencil measurements could not capture. Possibly, unmeasured leadership factors could have impacted the teams. For example, if there was a strong leader who had confidence in his answers for the NASA survival task and regardless of other members' feelings, the leader directed the team discussions

toward his preferred rankings, there may have been team members dissatisfied with the group dynamic. These teams might have had higher scores as a team and thus demonstrated a synergetic effect on the measurement relative to the other teams without such leaders, but the team members with strong directive leaders were not necessarily happy with those circumstances.

This possibility is reminiscent of the Ohio State Leadership Studies that classified leader behavior into consideration or initiating structure leaders: Considerate leaders "act in a friendly and supportive manner" and the initiating structure leader "structures his or her own role and the roles of subordinates toward attainment of the group's formal goals" (Yukl, 2001, p. 50). Fleishman and Harris (1962) found inverse relationships between turnover rate and consideration leader behavior, and a positive relationship between turnover rate and initiating structure leader behavior. These relationships could be an explanation of this study's finding of a negative correlation between satisfaction and synergy. With a dominant leader who had also done well on the NASA task, the team would have been productive as indicated by the synergy score, but members may not necessarily have liked the leader and, in turn, the team. If the participants were not happy with a dominant leader who created team process that led to a better team score, their satisfaction toward the team would be negative. In contrast, a high consideration leader would provide more attention to the relationships among the group members who would have found the team experience more satisfying, but didn't attend to the group task.

The most important point would be whether the satisfaction of participants leads to high team productivity or effectiveness. Several studies have explored this possibility (i. e. Bass, 1990; Fisher & Edwards, 1988). Some studies have indicated that teams with high satisfaction toward their high consideration leader could not provide high productivity and that teams with low satisfaction toward their initiating structure leader provided high productivity; however, the results have been inconsistent and further studies to establish empirical theories are still necessary (Yukl, 2001, p.52). Even though the relationship between members' satisfaction and team productivity has not been well established, this study's result is

consistent with some of these past studies. Team productivity and effectiveness in this study could be influenced by the behavior of leaders who emerged during the team task. To capture the leadership effects, videotaping the communication among team members while they were working on the team task might lead to empirical data, rather than speculation.

One possible reason why this study did not get the expected result could be the relatively small sample size, $N = 43$, as the relationship was in the expected direction. An examination of synergy scores across teams indicated that of the 43 teams, eight teams experienced process loss, one team experienced neither process loss nor synergy, and 34 teams experienced synergy, thus indicating that there were effects of team process exhibited within the synergy variable. The maximum synergy score was 28.67, minimum synergy score was -14.00 , and the average synergy score was 9.17 with a 9.33 median. Clearly, the teams did exhibit effects of team process. It was not possible, however, to predict the level of synergy with the proposed variables.

FUTURE STUDY IMPLICATIONS

In this study, we assumed that team process influences team productivity in one way: when team process had positive impact, teams had exposed synergy, and when team process had negative impact, teams experienced process loss. However, the effects of team process are not straightforward. Mathieu and Schulze (2006) tested how team attributes, in terms of formal plans and knowledge, influenced team performance and how transition and interpersonal processes mediated the relationships over four episodes. They found that team knowledge and formal plans had a statistically significant impact on team performance over four episodes. However, unlike the expectation from empirically established theory, interpersonal processes did not have a significant mediation effect on team performance. The results of this study and Mathieu and Schulze's study suggest that teamwork knowledge or aptitude may not have a direct impact on team process in every situation. As previously mentioned, videotaping the team activity and analyzing the team process as well as investigating team leadership would facilitate the understanding

of the effects of team process and these techniques are recommended for future research.

Relating to the ambiguity of the definition of team process, the appropriateness of the definition of synergy could also be criticized. After experiencing team process, most teams in this study produced outcomes that were quantitatively better than the sum of the individual outcomes. However, it is possible that the effects of team process may have had other, qualitative components that were not measurable by the measurements within this study. In other words, it is possible that as the Gestalt definition (i.e., the whole is greater than the sum of its parts) of synergy implies, a team becomes a different entity than the simple sum of its individuals after going through the team process.

Conclusion

In this study, we examined how aggregated general cognitive ability, teamwork aptitudes, and personality affect team level satisfaction, productivity and synergy. From the results of past studies, it was expected that teams with individuals who have higher teamwork aptitude and cognitive ability would display team efficiency more than those with lower teamwork aptitude, and cognitive ability. Also, it was expected that dispositional characteristics of individual would have an impact on team level satisfaction. Less satisfied teams experienced more synergy than teams with individuals who were satisfied with their teams. Among the studied variables, cognitive ability was the most powerful variable to predict team productivity.

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Author Notes

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Table 1. Example of calculation of team productivity outcome

Items	Rank order (Correct)	Rank order (Individual)	Rank order (Group)	Individual Score ^a	Group Score ^b
Box of Matches	15	7	13	8	2
Food concentrate	4	2	5	2	-1
50 feet of nylon rope	6	10	8	-4	2
Parachute silk	8	9	8	-1	0
Portable heating unit	13	13	13	0	0
				$\Sigma = 5$	$\Sigma = 3$

^a Individual score = $\Sigma \{ \text{Rank order (correct)} - \text{Rank order (individual)} \}$

^b Group score = $\Sigma \{ \text{Rank order (correct)} - \text{Rank order (group)} \}$

Table 2. Example of synergy

Group No.	Individual score	Group mean of individual score (A)	Group score (B)	(A) -(minus) (B) = Synergy Score ^a
1	11			
1	12			
1	10	12	10	2
1	15			
2	8			
2	5			
2	9	9	15	-6
2	14			

^a Positive number indicates existence of synergy and, bigger number indicates better synergy.

Table 3. Means, medians, maximums, minimums, and standard deviations of interrater reliability of satisfaction subscales

	Mn r_{WG}	Median r_{WG}	Minimum r_{WG}	Maximum r_{WG}	SD r_{WG}
Group Member Satisfaction	0.86	0.91	0.27	1.00	0.15
Team Satisfaction	0.97	0.98	0.75	1.00	0.04
Mutual Satisfaction	0.94	0.95	0.73	1.00	0.05
Internal Motivation	0.69	0.81	-0.19	0.96	0.28
General Satisfaction	0.95	0.97	0.71	0.99	0.05

Table 4

Mean and standard deviation of studied variables for 129 respondents with 43 teams

	Individual Level			Team Mean		
	M	Median	SD	M	Median	SD
	n = 129			n = 43		
Teamwork KSA	19.39	19.00	4.77	19.39	19.67	2.66
Conflict Management	2.74	3.00	0.96	2.74	2.67	0.47
Collaborative Problem Solving	4.03	4.00	1.74	4.03	4.00	1.16
Communication	6.80	7.00	1.90	6.80	7.00	1.06
Goal Settings and Performance Management	2.83	3.00	1.34	2.83	3.00	0.86
Planning and Task Coordination	2.99	3.00	1.23	2.99	3.00	0.66
Big-Five Personality						
Extraversion	48.08	48.00	10.00	48.08	48.00	5.77
Agreeableness	60.00	61.00	7.53	60.00	59.33	4.20
Conscientiousness	53.64	55.00	9.33	53.64	54.33	6.01
Emotional Stability	46.48	47.00	9.63	46.48	46.00	5.12
Openness	54.42	55.00	8.08	54.42	55.00	4.78
Satisfaction	104.55	105.00	12.13	104.55	105.33	9.17
Group Member Satisfaction	16.78	17.00	2.77	16.78	16.67	1.95
Satisfaction for Internal Motivation	24.69	24.00	4.09	24.69	25.00	2.42
General Satisfaction	17.25	18.00	2.30	17.25	17.33	1.55
Team Satisfaction	13.42	13.00	2.13	13.42	13.33	1.23
Mutual Satisfaction	32.41	32.00	4.86	32.41	32.33	3.79
Cognitive Ability	19.91	20.00	5.01	19.91	20.00	3.26

Table 5

Correlations among variables tested in hypothesis 4

Items	1	2	3	4	5	6
1. Teamwork KSA Team Mean						
2. Cognitive Ability Team Mean	0.23					
3. Big-Five Personality Team Mean	0.33*	0.33*				
4. Satisfaction Team Mean	-0.14	-0.02	0.24			
5. NASA Team Score	-0.24	-0.35*	-0.39**	0.16		
6. Synergy	0.21	0.06	0.22	-0.36*	-0.76**	

Note. Low scores on the NASA exercise indicate more answers in agreement with NASA keyed answers

Table 6

Team level correlations between satisfaction subscales and synergy score

	1	2	3	4	5	6
1. Synergy Score						
2. Group Member Satisfaction	-0.24					
3. Internal Motivation	-0.32*	0.56**				
4. General Satisfaction	-0.42**	0.67**	0.61**			
5. Team Satisfaction	-0.17	0.56**	0.43**	0.71**		
6. Mutual Satisfaction	-0.30*	0.70**	0.44**	0.79**	0.72**	

N = 43

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.05 level (2-tailed)