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TEAM COGNITIVE ABILITY AS A
PREDICTOR OF TEAM PERFORMANCE

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Abstract

This study examined the relationship between team cognitive ability (average Scholastic Aptitude Test score) and team performance (a subjective coach's evaluation and an objective measure using Sagarin's Power Rankings) among NCAA Division I Men's Basketball teams during the 1991-92 season. Survey data from coaches of 109 teams indicated that team cognitive ability was significantly related to the coach's evaluation but not to the power ranking measure, and that team strategy strongly moderated the relationship between cognitive ability and both performance measures.

Team Cognitive Ability as a Predictor of Team Performance

A significant amount of research supports the positive relationship of cognitive ability with job performance (Hunter & Hunter, 1984; Humphreys, 1992). Cognitive ability has been shown to predict the occupation to which an individual belongs (Austin & Hanisch, 1990), training success (Ree & Earles, 1992), and various measures of productivity or job performance (Hunter, 1986; Schmidt & Hunter, 1992). In fact, based on the substantial amount of research regarding cognitive ability tests, Ree and Earles (1992) stated that "If an employer were to use only intelligence tests and select the highest scoring applicant for each job, training results would be predicted well regardless of the job, and overall performance from the employees selected would be maximized," (p. 88).

However, past cognitive ability research has primarily focused on the individual as the unit of analysis. Most research has been concerned with examining the validity of certain tests for predicting job performance in the context of personnel selection. Thus, not surprisingly, existing research has examined the relationship between an individual's scores on a particular cognitive ability and measures of the individual's job performance. While this research is consistently supportive of the relationship, recent trends in the redesign of work to focus on self-managing work teams might lead to questions as to whether or not the relationship exists at higher levels of analysis.

In spite of the fact that many of the new approaches to increasing organizational competitiveness such as Total Quality Management, Quality Circles, and Self-Managing Work Teams contain as one component the redesign of work around work teams as opposed to individuals, very little is known about the role that cognitive ability plays in determining team performance. Increasingly organizations are moving from individually-based work toward work that requires the interdependence of a number of individuals organized as a team (Mohrman, Mohrman, & Lawler, 1991). Areas such as innovation (Kanter, 1983), quality, (Hauser &

Clausing, 1988), new product development (Souder, 1988), sales and customer service (Cespedes, Doyle, and Freedman, 1989), organization change (Woodman, 1989) and high technology firms (Von Glinow & Mohrman, 1991) have addressed the importance of teams for execution. This calls for examining the concept of "team cognitive ability" and its role in team performance. Thus, the purpose of this paper was to examine the role of a team's cognitive ability in predicting team performance among NCAA basketball teams.

NCAA basketball teams provide a unique opportunity for studying cognitive ability and team performance. First, all players are required to take an established cognitive ability test (either the Scholastic Aptitude Test or American Collegiate Test), thus, cognitive ability scores are available for all team members. Because many highly recruited basketball players are at risk of not meeting the minimum entrance requirements and thus, precluding their eligibility, these scores are extremely important to coaches. Second, basketball is a team sport that exhibits almost all levels of interdependence (pooled, sequential, and reciprocal, Thompson, 1967), thus, simulating the types of interdependence that might exist among many work teams in organizations. Finally, because these teams compete directly with one another, there exist some relatively strong objective assessments of performance.

Cognitive Ability and Team Strategy

In spite of the abundance of research on the relationship between individual cognitive ability and individual job performance, there is no empirical evidence of a relationship between a work group's cognitive ability and the group's performance. With the increasing organizational use of work teams, whether or not the team's ability is related to its performance presents an interesting area of inquiry. Substantial theoretical reason exists for expecting such a relationship. Given the nature of NCAA teams' task, individuals are in many ways reciprocally interdependent. Both offensive and defensive schemes rely on substantial on-the-spot coordination among team members. Members must be able to engage in problem solving through monitoring the environment (i.e., the time left on the shot clock, placement of the other team's members, placement of their own

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team's members, etc.), and making decisions about which actions to take. Many of these decisions are based on rules provided through the practice sessions (i.e., training).

Thus, the nature of the task is relatively complex, and is characterized by reciprocal interdependence (Thompson, 1967). The nature of the interdependence speaks for examining cognitive ability at the group level of analysis. This is consistent with the resource-based view of strategy (Barney, 1991; Wright & McMahan, 1992, Wright, McMahan, & McWilliams, in press) and traditional treatments of human capital theory at the firm level (Parnes, 1984). Moeller, Schneider, Schoorman, and Berney (1988) recommended that researchers should collect their data at the level of analysis at which they intend to aggregate. Because our study sought to predict team performance, this required using a team measure of cognitive ability.

It is important to note that other constructs traditionally viewed at the individual level of analysis such as affect, absence, prosocial behavior, performance, and turnover have also been examined as group, as opposed to individual level, phenomena (George, 1990; George & Bettenhausen, 1990). For example, George (1990) found that negative affectivity within a group was negatively related to the extent to which the group engaged in prosocial behavior. In addition, George and Bettenhausen (1990) found that prosocial behavior measured at the group level was significantly correlated with the group's objective sales performance.

A similar movement from the individual to the group level of analysis might be of interest with regard to cognitive ability. An example of approaching cognitive ability at the group (in this case the firm) level of analysis is a recent study by Terpstra and Rozell (1993). These authors surveyed firms as to whether or not they used some popular selection practices, one of which was cognitive ability testing. The results indicated that the use of cognitive ability tests was strongly related to firms' performance as measured by annual profit, profit growth and sales growth for service industries, but was not related to performance in other industries. It is important to note that this study assumes that firms that do use these tests should have higher average cognitive ability than firms that do not. Thus, it is apparent that the results seem to indicate some support for the notion of a group's ability being related to that group's performance.

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Similarly, viewing cognitive ability at the team level, it is entirely possible theoretically that a team's average cognitive ability should be related to the team's performance. Substantial research demonstrates that cognitive ability primarily affects job performance through the acquisition of job knowledge (Hunter, 1986; Schmidt & Hunter, 1993) at the individual level. The acquisition of job knowledge at the individual level among highly interdependent individuals should be related to team performance for three reasons.

First, team performance requires that all of the individuals to acquire relevant job knowledge in terms of offensive schemes, defensive schemes, and appropriate reactions to certain game situations. This job knowledge is usually gained through extensive in class (team meetings/playbook) and on court (practice) activities. Cognitive ability should enable team members to more quickly learn the offensive and defensive schemes and to make better on the court decisions for their own individual roles. Second, in a highly interdependent situation such as a basketball team, all individuals must learn their fellow team members' preferences, tendencies, strengths, and weaknesses. Cognitive ability should enable team members to more quickly and thoroughly acquire this type of required job knowledge. Finally, because NCAA team members are student-athletes, they must also meet scholastic requirements while playing during the season. The loss of eligibility or even the threat of loss of eligibility for scholastic reasons can create at worst turmoil, and at best a consistent distraction from the main task within a team. Thus, cognitive ability should also better allow team members to fulfill academic requirements, and thus, avoid such distractions.

These propositions are consistent with the work of Bass (1980). In reviewing the literature on team productivity, he offered as one self evident proof that "The team product will be better, the more capable the average member," (p. 433). In fact, his model of team performance notes that the abilities of team members (as measured in part by intelligence tests) affect the task performance of team members, and he argued that this accounts for 50% of the variance in team performance.

Terborg, Castore, and DeNinno (1976) found empirical support for these propositions as well. These researchers had three- and four-person undergraduate teams work on land surveying projects. They found that scores on the quantitative section of the Scholastic Aptitude Test and cumulative grade point average were related to team performance as rated by the instructor. In addition, Hill (1982) found that group performance was positively related to the abilities of individual members. Finally, Tziner and Eden (1985) found that group performance was related to members' abilities, such that a high ability member's contributions were most pronounced when other members were of high ability.

However, in addition to the bivariate relationship that should be observed between cognitive ability and team performance, there is reason to believe that the relationship might be moderated by team strategy. A second proposition offerred by Bass (1980) is that "The greater the interdependence of the nonredundant individuals, the greater the opportunity for the group product to be more (or less) than the simple sum of their pooled performance," (p. 433). Similarly, O'Brien and Owens (1969) argued that the extent to which group member ability contributed to group performance depended on the degree of collaboration required by the task.

Empirical support for the moderating role of the task requirement in the relationship between team member ability and team performance also exists. For example, in spite of the fact that Ree and Earles (1991) found that a common prediction equation could be used for all jobs, they also found that incremental validity was gained by controlling for job type. This implies that abilities were, to some extent, different in the importance across jobs. Similarly, Hunter and Hunter (1984) present the data comparing the predictive validity of cognitive ability across job families. Their data provide evidence that although cognitive ability is a valid predictor for all jobs, in fact the predictive value increases as job complexity increases. Finally, Terpstra and Rozell's (1993) findings that industry moderated the relationship between the use of cognitive ability tests and financial performance also provides some evidence that cognitive ability might not be equally related to team performance in all situations.

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This leads to examining the ways in which certain teams might possess greater or lesser cognitive ability requirements due to the amount of cognitive complexity of the jobs as called for by the team's strategy. In NCAA teams, the jobs are ones that are relatively restricted in the range of required behaviors. However, when job requirements differ, these generally differ due to the team's chosen strategy. For example, Wright, Smart, & McMahan (1993) examined the fit between human resources and strategy among NCAA basketball teams, and identified three potential team strategies.

According to Wright et al. (1993), the speed strategy is one with little planned playmaking. Rather this strategy entails running fast breaks and pressing defenses with very few set plays (e.g., UNLV under former coach Jerry Tarkanian). This type of strategy poses a great requirement for physical skills (e.g., speed, quickness, etc.), with less emphasis on cognitive skills. On the other hand, a finesse strategy is one where each member of the team must memorize a set of plays, and run them as an integrated unit (e.g., Indiana under coach Bobby Knight). These plays require exact timing and extremely accurate execution. In this strategy physical skills become less important relative to a speed strategy, and the cognitive skill requirements increase because of the need for team members to be able to adequately execute the offensive and defensive schemes. Finally, the power strategy is similar to the finesse strategy, in that it requires running a planned offense usually consisting of a number of plays. However, the major difference is that in the power strategy most plays are designed to be run around inside players (e.g., LSU under coach Dale Brown when Shaquile O'Neal played there). Thus, both the physical and cognitive skill requirements tend to fall between the speed and finesse strategies.

Because the three strategies might differ in their cognitive requirements, team strategy should play a moderating role in the relationship between cognitive ability and team performance. One would expect that the relationship between SAT and performance should be strongest for the finesse strategy, followed by the power strategy, with the speed strategy exhibiting the weakest relationship to performance.

Thus, the two research questions to be addressed in this study are:

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Research Question 1: Does a team's average cognitive ability predict team performance?

Research Question 2: Does a team's strategy moderate the relationship between cognitive ability and team performance?

Method

Sample

The sample consisted of NCAA Division 1 men's basketball teams. The survey was sent to all 300 teams. Completed surveys were received from 143 teams for an overall response rate of 48%. However, 9 teams failed to identify their schools, thus the data on which the analyses are based was made up of 134 teams, for a final response rate of 45% of the total population.

Measures

Team Cognitive Ability. Respondents were asked to indicate the number of their top 8 players that fell within each 50-point category (e.g., 700-750; 751-800;....1151-1200; over 1200) on the Scholastic Aptitude Test (SAT). The SAT is an extremely valid measure of general cognitive ability, and has been shown to be predictive of a number of different types of intellectual performance (Jensen, 1980). In addition, based on normative samples, the reliability of the SAT has been estimated to be over .90. Team cognitive ability was assessed as the average SAT score for the top 8 players. This was computed by multiplying the number of individuals who fell in each category by the midpoint of that category, summing and dividing by 8. While admittedly a rough measure of cognitive ability, the roughness of the measure would entail a random, rather than systematic error component, and thus, should provide an underestimate of the true relationship between this variable and other variables.

Team Strategy. As part of a larger study on the fit between human resources and team strategy, Wright et al (1993) conducted interviews with coaches to determine the types of strategies available. These interviews indicated that teams tend to exhibit three types of strategies: Speed, power, and finesse. All teams tend to exhibit each of these strategies to some extent, therefore, the survey attempted to assess the extent to which the team used each of the three

strategies by asking respondents to indicate the percentage of their team's emphasis on each of the three strategy options. However, in order to conduct the analyses, we classified each team as either a power, finesse, or speed strategy according to which strategy was emphasized the most.

Team Performance. Team performance was assessed in two ways. First, Sagarin's Power Rankings (USA Today, March, 1992) provided an objective assessment of the team's performance over the course of the season. Won-Lost records tend to ignore the quality of a team's competition and the average margin of victory. The power ratings provide a measure of performance that controls for quality of competition (as measured by won-lost records of opponents) as well as a number of other variables which confound the won-lost outcome variable (e.g., home v. away, margin of victory, etc.). These ratings form the basis for ranking the 300 NCAA Men's teams. Thus, Sagarin's final rankings for the 1991-92 season were used as an objective measure of team performance.

While the rankings provide an external measure of team success, they ignore the dayto-day performance of the team. For example, teams can exhibit conflict among players, between players and coaches, disciplinary problems, or problems in learning the system in terms of the behaviors required within the particular offensive and defensive schemes as dictated by the team's strategy. Thus, a subjective assessment of the team's performance was assessed by asking the respondents to indicate their agreement with seven statements regarding the day-to-day workings of the team (see Appendix A). These items were summed, and exhibited a coefficient alpha internal consistency reliability estimate of .91.

Procedure

Surveys were mailed to all 300 NCAA Division 1 Men's Basketball teams during the summer of 1992. The survey was mailed to a school along with a self-addressed postage paid return envelope. A cover letter explained that the purpose of the survey was to examine how an organization's people are linked to its strategy and how that link affects performance. Respondents were assured that their responses would remain confidential. Approximately 6 weeks after the

initial survey was sent out, a follow up letter and set of surveys was sent to those schools that had not yet responded.

Results

Due to missing data, useable data was available for 109 of the 134 teams that responded. The means, standard deviations, and intercorrelations among the variables are presented in Table 1. Team strategy was dummy coded as two variables with the speed, finesse, and power strategies coded 1,0; 0,1; and 0,0, respectively.

Insert Table 1 Here

In order to test the research questions, two hierarchical regression equations were computed. The first equation regressed the coach's evaluation of performance on the team SAT score in the first step, the dummy-coded strategy variables in the second step, and the SAT by strategy variables in the third step. The second equation was similar, except that the power ranking was used as the dependent variable. If team SAT was related to performance, a significant amount of variance would be observed in the first step of each equation. If the relationship between SAT in performance was moderated by team strategy, then a significant amount of incremental variance would be explained in the third step of each of the equations. These results are presented in Table 2.

Insert Table 2 Here

As can be seen in Table 2, team SAT, when entered alone, predicted the coach's assessment of performance (R^2=.06, p<.05), but not the power rankings (R^2=.00, n.s.). Thus, the

answer to the first research question is a qualified yes, as the team SAT was significantly related to only one of the performance measures.

As to whether strategy moderates the relationship between team SAT and performance, as can be seen in Table 2, significant variance was explained by the SAT by Strategy interaction terms for both the coach's evaluation of performance ($R2=.06$, $p<.05$) and the power rankings ($R2=.19$, $p<.01$). Thus, the answer to the second research question is a definitive yes. The nature of the moderating relationship for the coach's and power ranking performance measures are illustrated in Figures 1 and 2, respectively. These figures illustrate the the relationship between Team SAT and performance is strongest among teams using a finesse strategy.

Insert Figures 1 and 2 Here

Discussion

This study presents some evidence for the validity of examining abilities such as cognitive ability at the team level. The results indicate that a team's average SAT score is related to the coach's evaluation of performance in a bivariate sense, however, this relationship was not observed for the objective power ranking measure of performance. It is important to note that the coach's measure contained items such as "Our players were very quick learners," and "Our players had problems with their studies." These items should strongly tap the day-to-day learning activities of team performance, which are missing from the more objective measure. In many ways this performance measure could be compared to a supervisory evaluation of performance, and although subjective, taps an aspect of performance that is not measured by the more objective power ranking.

It is also interesting to note that the correlation of .24 is an uncorrected correlation. Given the rough nature of our cognitive ability measure, it is likely that this measure is more unreliable than an individual SAT score might be. In addition, given the nature of our sample (i.e., student-

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athletes who tend to score lower relative to the non-athlete population) it is likely that the range of cognitive ability was restricted relative to the population. Thus, it appears that our observed correlation of .24 is an underestimate of the true relationship between team cognitive ability and the coach's evaluation of performance.

In addition, our results point to the moderating role of strategy in the relationship between cognitive ability and team performance. As can be seen in Figure 1, the relationship between SAT scores and the coach's evaluation of performance was stronger for the finesse and power strategies relative to the speed strategy. This seems to imply that cognitive ability is less important to team success for teams that engage in a speed strategy, but that it is critically important to success for teams using one of the other strategies. This likely stems from the fact that the latter strategies have a relatively greater cognitive requirement through the memorization of plays and sequences. Coaches using a finesse strategy seem to believe that they will "outthink" (i.e., "play smarter" than) the other team, and there appears to be some evidence to support that assertion as being critical to success.

However, the nature of the interaction, while strong, was not exactly the same when using the objective rankings. In fact, as can be seen in Figure 2, these data seem to indicate that team cognitive ability is somewhat negatively related to performance for the speed and power strategy. However, the strong relationship between cognitive ability and performance for the finesse strategy is still observed.

In a larger context, this study provides empirical support for recent research examining the role of human resources in organizational performance. The resource based view of the firm (Barney, 1991; Wernerfelt, 1984) focuses on the physical, organizational, and human capital resources under a firm's control as the major determinants of a firm's competitive advantage. Applying the resource based view to human resources, Wright, McMahan, and McWilliams (in press) argued that a firm's human capital resources can play a role in sustained competitive advantage. These authors discussed cognitive ability of organizational members as one

characteristic of human resources that might affect organizational performance. This study provides some indirect support for their propositions.

One limitation of this study was the inability to obtain exact SAT scores for each individual by position. Our hope in designing the survey was to have coaches provide individual SAT scores and performance statistics for individuals so that we could examine the relationship between SAT and individual performance as moderated by position (e.g., guards, vs. forwards, vs. centers). However, our conversations with coaches made it clear that they would be unwilling to provide individual SAT scores in a way that could identify the players involved. In addition, to do so would have been a breach of APA ethical guidelines because the individual players would not have provided an informed consent to supply us with such information. Thus, we could only obtain a rough estimate of Team SAT scores.

One potential criticism of the present study is its counterintuitiveness. Many believe that on a task with extremely difficult physical ability requirements such as playing basketball, cognitive abilities would be irrelevant. In fact, anecdotal data from our discussions with coaches indicated that they believed that cognitive ability (at least as measured by the SAT or ACT) was unrelated to performance. These coaches consistently argued that physical skills were of most importance. While performance on the task is in large part determined by physical abilities, at the level of collegiate basketball, these abilities become restricted relative to the general population. Thus, in the situation where restriction exists in one determinant of performance, it is not at all unusual to find that other variables exhibit relationships with performance. This is similar to the fact that when cognitive ability is restricted in range in a given sample, other predictors, such as Need for Achievement, tend to relate more strongly to performance (Ree & Earles, 1993). Thus, we do not take issue that within the larger population, physical skills/abilities are more strongly related to basketball performance than are cognitive abilities. However, that does not negate the fact that cognitive abilities still might predict performance within our sample as was observed in this study.

In addition, one could criticize the relationships observed between SAT and the coaches evaluation of performance as suffering from common method variance since both measures were obtained on the same survey. However, four facts argue against the validity of this criticism. First, the SAT scores were not perceptual measures, but were rather reports of objective information. Had we asked coaches to evaluate their perceptions of the cognitive ability of team members, the criticism of common method variance might be legitimate. However, we only asked coaches to report the objective SAT scores of team members, information that is readily available and extremely important to coaches. Second, while common method variance is especially a problem in examining bivariate relationships, it is difficult to envision it playing a role in interactive relationships. Given the fact that team SAT interacted with strategy to predict performance, it is unlikely that common method variance was the cause.

Third, the fact that somewhat similar results were also observed for the more objective power ranking measure of performance speaks against the validity of the common method variance criticism. Finally, common method variance usually stems from respondents' perceived model that certain relationships must exist. All of our discussions with coaches both before the study and in discussing the observed results as well as the frequent criticisms coaches have for NCAA attempts to raise the minimum SAT scores indicate that coaches do not see any kind of a relationship between SAT scores and performance. (We might note that some coaches believe that a player's intelligence might contribute to performance as in the case of the finesse strategy, but they do not believe that the SAT measures intelligence.) Thus, our findings that SAT scores predict team performance run completely contrary to what appears to be the current consensus among coaches.

In conclusion, we found substantial evidence for the idea that team cognitive ability is related to team performance, and that this relationship is moderated by team strategy. This points to the need for future research to address the issue of how other characteristics of teams might be related to team performance. In addition, we only viewed ability as a mean level. It is entirely possible that the variance in ability also influences the team's performance, although it is unclear as whether higher variance might be associated with higher (i.e., diversity increases performance)

or lower (i.e., the chain is only as strong as the weakest link) performance (Bass, 1980). Obviously, this is a question to be addressed in future research. In any case, this study provides support for the notion that the relationship between cognitive ability and performance may hold at the team, as well as the individual level of analysis.

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Authors Notes

Table 1.

Table of Means, Standard Deviations, and Intercorrelations Among the Study Variables.

	Variable	Mean	SD	1	2	3	4	5
1.	Team SAT	864.1	192.2	-				
2.	Speed Strategy	42	.50	-.09	-			
3.	Finesse Strategy	34	.47	.04	-.66*	-		
4.	Performance (Coach)	4.43	1.10	.24*	.09	.01	-	
5.	Performance (Ranking)	137.2	84.4	-.04	-.13	.19*	-.35**	-

* p < .05; ** p < .01

Table 2.

**Results of Regression Equations Regressing Performance on
Team SAT, Strategy, and the Interactions**

Variable	R2 Change Beta[a]		R2 Change Beta[a]	
	Performance (Coach)		Performance (Rank)	
Step 1	.06[*]		.00	
SAT		-.01		-1.30
Step 2	.02		.04	
Speed Strategy		-.39		-3.88
Finesse Strategy		-1.94		-4.02
Step 3	.06[*]		.19[**]	
SAT X Speed Strategy		.49		3.63
SAT X Finesse Strategy		2.01[*]		3.91
Total	.14[*]		.23[**]	

[*] $p < .05$; [**] $p < .01$

[a] Beta's for each variable are from the full regression model.

Appendix A

Items used in Coach's Performance Measure

1.   Our team had an outstanding season.

2.   Our players were very quick learners.

3.   Our players got along well with each other.

4.   Our players had outstanding attitudes.

5.   Our players had no conflicts with coaches.

6.   Our players never needed to be disciplined.

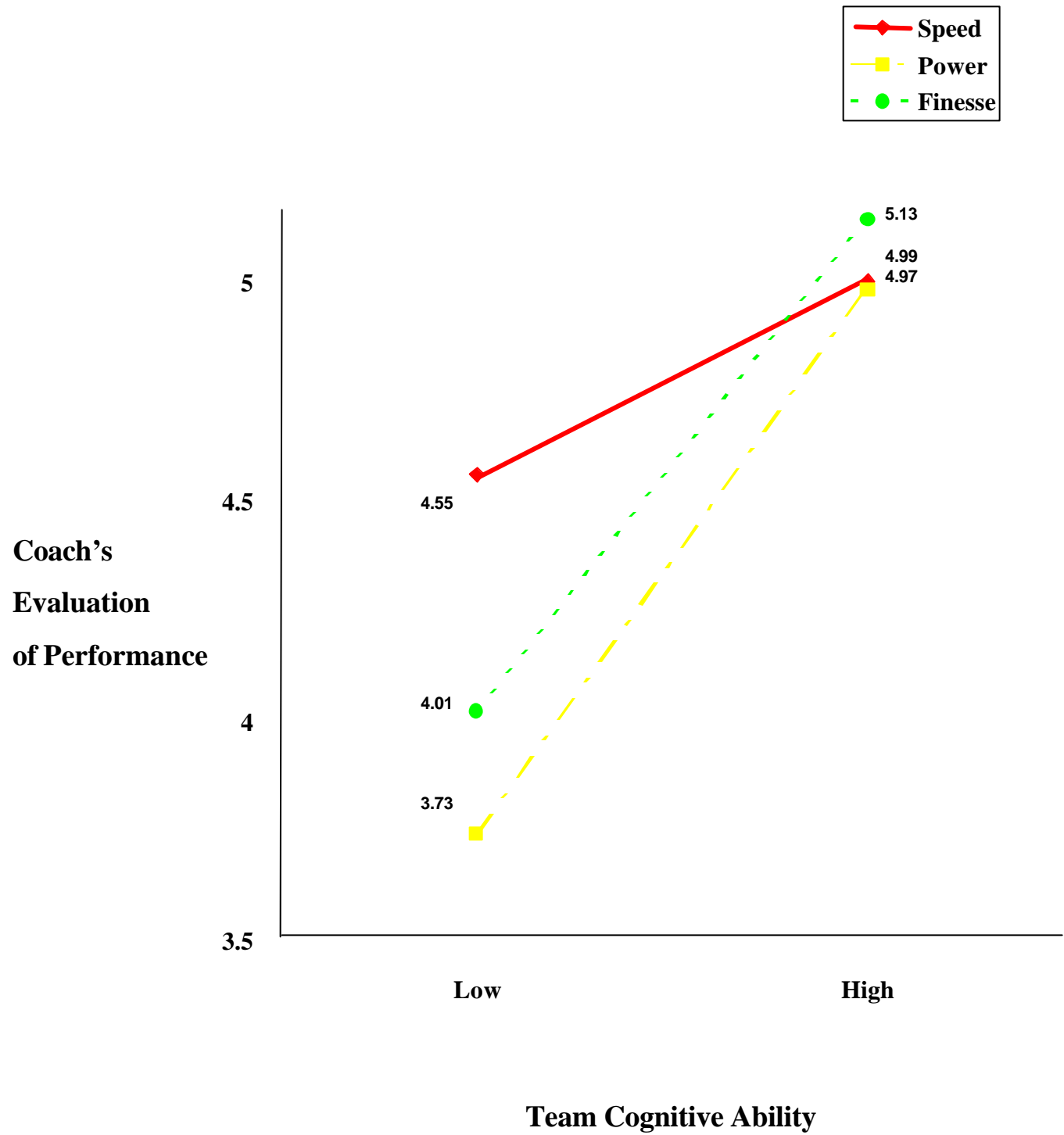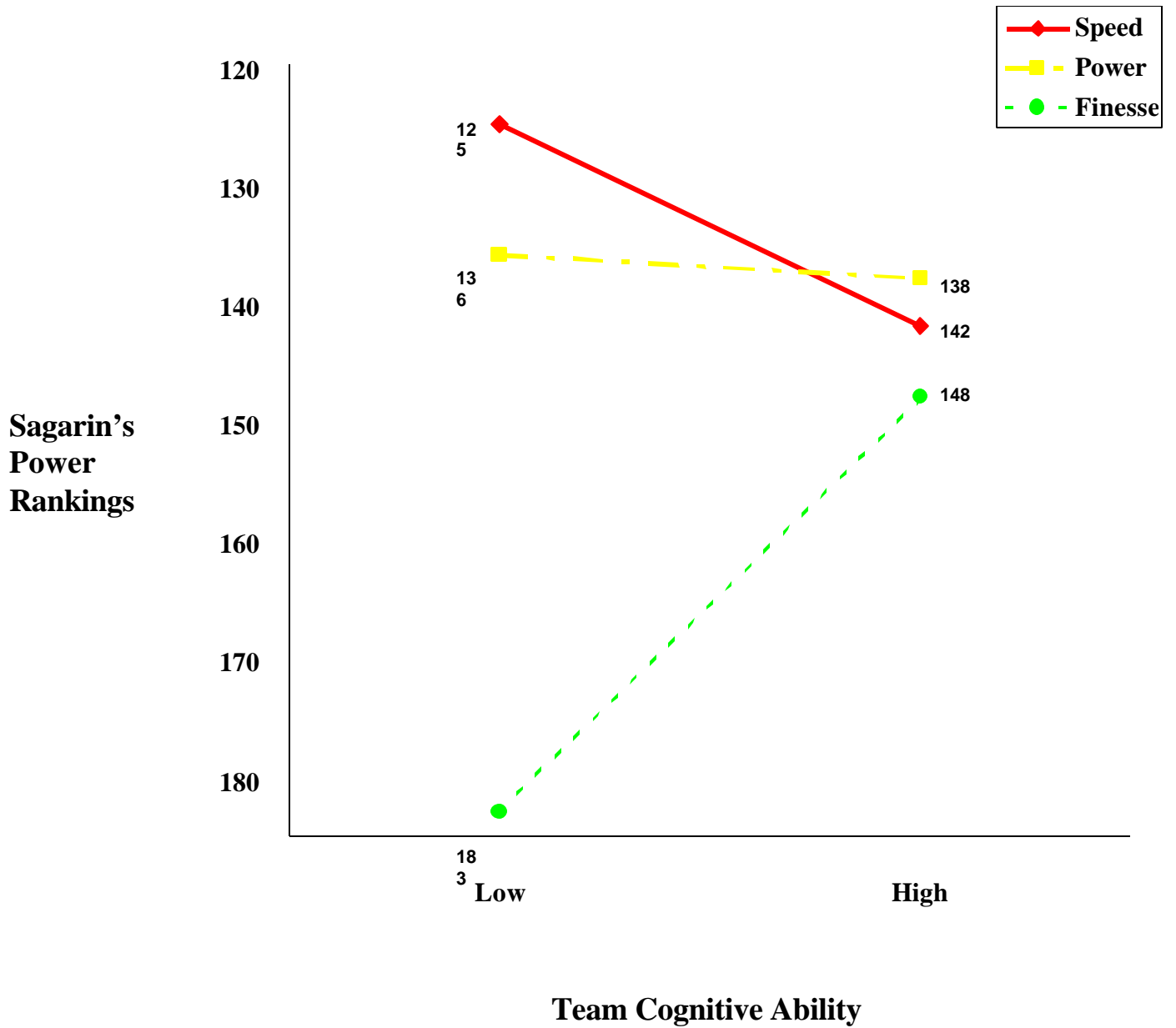7.   Our players had problems in their studies. (R)

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Figure 1

Figure 2

*Low Ranking Equals High Performance