Talent Selection in Youth Baseball

Factors that Predict End-of-Season Success

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INTRODUCTION

One of the most appealing reasons for talent research in sport is the hope that future talent can be predicted in "key transferable skills."[1] Previous talent research has used a variety of measures to select talent but typically focus on only a small portion of physical skills or attributes (height, weight, strength, and speed). Some research has included skill-specific tests (slalom dribbling in handball, serving in volleyball) but the area of talent research has not investigated the dynamic nature of talent in sport. This neglect leads to several problems (see Abbott et al., 2005, for a review). In this paper we will enumerate five basic problems with talent research as it is often conducted, introduce the Dynamical Systems model to eliminate these problems, and then apply this model to predicting whether athletes in our study were selected for their leagues' All-Star teams.

HOW IS TALENT RESEARCH USED?

Talent research studies typically test discrete physical measures such as upper body strength, vertical jump, linear speed, and the cardiovascular endurance of athletes in an attempt to predict future performance. Early identification would provide young athletes with the several years needed for developmental training to become elite-level performers.[2] In baseball, specific talent research studies have indicated that vertical jump,[3] vertical jump and medicine ball throw,[4] and Profile of Mood States (POMS)[5] are the best predictors of baseball performance. But talent research can be a confusing area and perhaps this is why it has sparked controversy.

PROBLEMS IN TALENT RESEARCH

One problem with talent-related research is a wide range of developmental levels in participant groups, making results difficult to compare or correlate. Another is the intent of how the information is used, which skews the directions of research and can color the reporting of the results. Three baseball related studies in the field studied college-level (Friend & LeUnes, 1990), professional (Grove, 2001), and high school and Little League baseball players (Watkins, Garcia, & Turek, 1994).[6] All three articles attempted to identify measures of physiological, perceptual, and psychological variables without the goal of eliminating individuals from future participation. The goal here was to identify variables that can be improved throughout the developmental process rather than be used to exclude individuals from participation.

DYNAMICAL SYSTEMS MODEL

Abbott et al. (2005) reviewed five reasons why identifying and eliminating potential athletes based solely on physiological measures (i.e. organismic constraints) is questionable. The first reason is that it is too difficult to measure the value of a physiological variable at an immature point in time and expect that variable to remain constant and unchanged throughout an individual's development.[7, 8, 9] For example, height is advantageous in several sporting domains (basketball, volleyball, football, and baseball). Abbott and Collins (2002) report significant variability in height between boys and girls aged 11–12. There are many maturational changes that take place from age 11–12 through the next few years. The previous talent research conducted on baseball does not take into account individual variability, nor did it include a baseball-specific test for the skill of batting.

The second problem is that performance is constrained by several factors that are not all genetically determined (Abbott et al., 2005). The theoretical framework known as the dynamical systems perspective[10] suggests that skill acquisition arises from an interaction between constraints within the organism, in the environment, and in the task.[11] An individual will have to go through periods of instability in order to reach a more stable pattern of movement or perception. This is the key tenet of dynamical systems and also appears to be a major flaw in past talent research studies. Several studies measured a limited array of physiological factors that may play a role in the performance of the skill being tested; however, these studies only tested a limited spectrum of what actually enhances skill acquisition and success in sports.[12, 13] Summers (2005) mentioned principles that cover metabolic, neural, biomechanical, and psychological processes. For example, if an athlete lacks motivation to practice and improve in a particular sport (a psychological variable), then he/she is highly unlikely to improve even if they are extremely talented physiologically.

The third problem associated with talent research according to Abbott et al. (2005) and Morris[14] is that discrete performance indicators are poor predictors of talent. Fleishman and Mumford as well as various other studies conducted by Fleishman and colleagues consistently showed particular abilities related to skill acquisition change as an individual continued to practice during development.[15, 16] As previously stated, variations in development result from interaction between the environment, the task, and personal (organismic) constraints (Newell, 1986). Of particular interest to this research, and a factor that seems to be missing in previous studies, are psychological variables (organismic constraints) such as motivation. Thelen and Ulrich (1991) noted certain behaviors do not emerge to support other processes (physiological and perceptual abilities) until they are ready to emerge.[17] If rate limiters such as lack of motivation or muscular strength are present, then identifying talent for immediate or future development will be difficult if not impossible.[18]

According to Davids, Lees, and Burwitz[19] and Helson, Hodges, van Winckel, and Starkes,[20] the talent selection criteria used are often unstable during developmental transitions in an athlete's career. This is the fourth problem in talent research studies. Athletes learning a new skill (regardless of age) go through transitions in performance. Based on these transitions, performance may become unstable (the athlete may even appear to regress in the skill). Using dynamical systems terms, this is called a critical fluctuation where a stable characteristic of performance becomes unstable in order for it to scale up to a more effective state (Abbott et al., 2005). Therefore, it would be increasingly difficult for an athlete to be correctly and accurately identified as talented if the athlete was observed during one of these periods of critical fluctuations in development.

The fifth problem associated with talent research studies is they typically do not take into account factors that support successful development towards acquisition of skill.[21] Recruiters and scouts look for individuals with the capacity to develop into athletes who will garner significant success later on. However, many talent research studies (Friend & LeUnes, 1990; Grove, 2001) measure performance at a particular moment, rather than skill acquisition potential. The major limitation with this method of testing is eliminating potential talent too early. A child's desire to participate in a particular sport may be squashed or dissuaded by negative-seeming test results. For this reason, season-long statistics for batting average (BA) and on-base plus slugging percentage (OPS) are preferred for analysis over momentary test results.

CONCEPTUAL FRAMEWORK

The previous five problems do not paint a flattering picture but enumerating them does motivate us to design a study to identify measurable factors which can enhance the accuracy and predictability of talent research. In this study, we attempt to predict which athletes should be selected for their league's All-Star team by utilizing a Dynamical Systems perspective. Talent selection is a process which needs to take into account that successful performance is a result of the interaction of physical (strength, speed), perceptual (hitting pitches at different speeds and trajectories), and psychological factors (self-efficacy).

METHODOLOGY

Participants

Participants were 68 boys between 11 and 14 years of age who played in a recognized organization (i.e. Little League or Dixie Youth League). One hundred participants were tested during the study but 32 participants had incomplete data sets and were excluded from the statistical analysis. Approval from the University's Institution Review Board was obtained prior to administering the testing protocol. In addition, permission was obtained from league officials (i.e. league president or appropriate board members). A letter was sent to parents of children in the league asking them to volunteer for this study and participants' parents signed a consent form in order for children to participate. The organizations were located in Central Virginia. Each participant was required to be a member of an official team within that organization in order to be eligible for the league's All-Star team.

A total population sample was better suited to the research than a selection because to determine if the measurable factors that differentiate successful versus unsuccessful performance would predict All-Star selection, then a full range of performance levels was required. We tested five independent variables: (1) lower body power potential (organismic constraint), (2) upper body power potential (organismic constraint), (3) 30-yard dash (organismic constraint), (4) hitting 60 mph fastballs and right- and left-handed curveballs (task constraint), and (5) level of self-efficacy for hitting a baseball (organismic constraint). We needed approximately 100 participants in order to reveal major differences between successful and unsuccessful performance.[22]

Procedure, Instrumentation, and Independent Measures

Data collection occurred through participant observations. No subjectivity was involved in testing any of the independent variables. Objective tests aimed at differentiating between successful and unsuccessful batting performance were administered, as follows:

Vertical Jump (physical test). Lower body power potential was measured using a Vertec stationary vertical jump tester. A piece of athletic tape was placed on the floor indicating where the participant's feet should be placed and each participant was asked to extend his jumping arm to provide a standing reach measurement. Each participant was allowed three opportunities to jump as high as possible and touch the Vertec. This device includes colored plastic swivel vanes arranged in ½" increments attached to a telescopic metal pole that can be adjusted to the athlete's standing reach.[23] The participant was allowed to bend at the knees and swing the arms upward to initiate his jump. If the participant used a drop step technique (dropping the foot back then forward to initiate the jump), that jump would be disqualified and the tester would re-instruct the participant on the correct form.

Medicine ball toss (physical test). The side medicine ball toss has been shown by Ikeda, Kijima, Kawabata, Fuchimoto, and Ito to be a more skill-specific movement than the exercise used in the field tests conducted by Friend and LeUnes (1990) and Grove (2001).[24] It used a 2kg medicine ball with the participant standing in his batting position facing perpendicular to the throwing area. The participant held the medicine ball in both hands and rotated his body back and then forward (similar to a swinging motion). During the forward rotation, the participant released the medicine ball to throw it for maximum distance.

30-yard dash (physical test). The 30-yard dash time was conducted in an indoor facility so surface and weather could be controlled. Timing began when the participant swung the bat and ended when they touched first base. Time was recorded using a Cronus Pro Survivor stopwatch and then recorded for data analysis (Leavitt, personal communication, April 12, 2006). Pilot testing revealed a reliability of .892 which was within the acceptable statistical parameters. In addition the test was conducted by the primary researcher for each participant tested.

Hitting tasks (perceptual). Each participant took fifteen swings on three types of pitches from a pitching machine 46 feet away. Each saw five 60 mph fastballs, and five each of 50 mph right- and left-handed curveballs A Jugs II pitching machine was used in order to ensure each participant received the same treatment. Balls used were Jugs Sting Free dimpled white batting cage balls to ensure uniformity of pitches. Each area of the batting cage had a point value and the total number of points was calculated for each round.

Table 1. Scoring for Perceptual Tests

-2 points	for a ball that strikes the top of the batting cage net (fair)
0 point	foul ball or swing and miss
1 point	ground ball off the side of the batting cage (fair)
2 points	ground ball off the back net (fair)
3 points	line drive off the side of the net (fair)
4 points	line drive off the L-screen (fair)
5 points	line drive off the back of the net

Self-efficacy. The fifth and final test was a questionnaire that assessed the participant's perceived self-efficacy. Players' self-efficacy beliefs can contribute to their successful or unsuccessful performance in baseball. "Perceived self-efficacy is a judgment of capability to execute given types of performances."[25] Outcome expectations are judgments about how the individual performed in the skills being tested. The individual is likely to derive his outcome expectations from three different forms that include positive and negative physical, social, and self-evaluative performance outcomes.[26] This perceived efficacy is critical because it affects behavior, goals and aspirations, outcome expectations, perceptions of preventing successful outcomes, and opportunities for success.[27, 28] Since self-efficacy is measuring a perception of how one expects to perform a given task, the modified self-efficacy questionnaire was administered after the physical and perceptual measures were collected. Participants were instructed to answer the questions based on their previous year participating in baseball rather than from the tests they just participated in on a scale of 0–100% confident. (Sample: 100 percent would correspond to "Overall I am confident I can perform well when it comes to batting in baseball.")[29]

RESULTS

Statistical Analysis

All variables were inspected for means and standard deviations. Following that, correlation coefficients were calculated between independent variables prior to the main analysis. Scores on vertical jump (VJ), medicine ball side throw (MB), home-to-first times (H1), 60 mph fastballs (60), left-handed curveballs (LC), right-handed curveballs (RC), and scores from a self-efficacy questionnaire (SE) were recorded. Season-long batting average and on-base plus slugging percentage (OPS) were recorded and, along with VJ, MB, H1, 60, LC, RC, and SE, were evaluated using a stepwise discriminant analysis which includes independent variables (predictor variables) and a dependent variable which is a grouping variable.[30] This particular grouping variable was determined by whether the individuals made their respective All-Star team.

Performance Characteristics of Participants

Scores were obtained for the seven independent variables in one testing session by the primary researcher. Batting averages (BA) and OPS were also collected at the same time unless the coach needed to calculate or locate participants' statistics for those two categories. Each independent variable was recorded on a data sheet and later entered for data analysis. Thirty-two participants had incomplete data (missing OPS and BA) and were therefore excluded from the final data analysis. Each participant was asked to disclose whether they made their league's all-star team. Group statistics are also shown in Table 2 to provide an example of mean differences between groups. Table 2 shows there are differences between groups which suggest that there are differences between all-stars and non-all-stars in this study.

Table 3 illustrates a test of equity of group means which provide evidence as to which variables provide statistically significant differences between all-stars and non-all-stars for all independent variables with BA and OPS producing the best fit at the .05 level. Based on the significance level, it is unlikely the researcher mistakenly found differences. A correlation matrix

Table 2. Group Statistics

				Valid N (listwise)	
ALL-STAR		**Mean**	**Std. Deviation.**	**Unweighted**	**Weighted**
yes	BA	.5206	.12863	45	45.000
	OPS	1.3477	.32879	45	45.000
	MEDBALL	293.2778	62.08348	45	45.000
	HOME	3.7438	.41921	45	45.000
	FB	3.0444	2.68798	45	45.000
	RCB	2.9333	3.07778	45	45.000
	LCB	2.7778	2.61889	45	45.000
	SE	79.0978	13.23485	45	45.000
	VJ	14.3778	2.48440	45	45.000
no	BA	.3747	.14174	23	23.000
	OPS	.9022	.20358	23	23.000
	MEDBALL	307.2609	61.16313	23	23.000
	HOME	3.6509	.45573	23	23.000
	FB	1.7391	2.66658	23	23.000
	RCB	1.6087	2.27115	23	23.000
	LCB	1.2609	2.15781	23	23.000
	SE	69.7957	22.45639	23	23.000
	VJ	14.5217	3.14599	23	23.000

Table 3. Equity of Group Means

	IV	Wilks' Lambda	F	Sig
Season-long statistics	BA***	.783	18.268	.000***
	OPS***	.652	35.177	.000***
Physical variables	MEDBALL	.988	.780	.380
	HOME	.989	.705	.404
	VJ	.999	.043	.837
Perceptual variables	FB	.948	3.608	.062
	RCB	.952	3.324	.073
	LCB***	.920	5.719	.020***
Psychological variable	SE***	.935	4.623	.035***

(Table 4) shows variables selected in the study were independent from one another. In other words, this study did not measure the same underlying concept twice. Table 4 illustrates a correlation matrix. Two variables (BA and OPS) had higher levels of multicollinearity; however, they did not exceed the .85 level (meaning these two variables are highly correlated but they are not measuring the same construct).

Statistical analysis indicated that four independent variables contributed significantly to the grouping differences (BA, OPS, LCB, and SE).

Accuracy of the Predictions of All-Stars versus Non-All-Stars

Results of the study show 80.9 percent of participants were correctly classified into the predicted group based on the independent variables selected. Significant independent variables (BA, OPS, LCB, SE) correctly classified 80.9 percent of the sample population indicating independent variables perform reasonably well. Table 5 illustrates the accuracy of the prediction. There was a slight difference in predicting group membership when adjusting for the differences in group size. Table 6 illustrates that predicting All-Star membership improved by more than two percent. However, correctly predicting non-All-Stars decreased slightly. Discriminant function analysis allows the researcher to reject the null hypothesis that physical, psychological, and perceptual characteristics cannot determine placement on an All-Star team. It is important to mention that 11–12 year-olds are selected to different All-Star teams than 13–14 year-olds. Due to this distinction age was not a consideration in the analysis because the age groups are selected to different All-Star teams.

From the data listed above, the following hypotheses cannot be rejected. Discrete physical performance indicators are a poor determinant of success in batting in baseball. On the other hand, there is evidence that perceptual ability in striking a baseball is a useful grouping variable. In other words, selecting a test that measures one's ability to strike a ball at varying speeds and trajectories can differentiate an All-Star from a

Table 4. Pooled Within-Groups Matrices- Correlations Between Variables

		BA	OPS	MEDBALL	HOME	FB	RCB	LCB	SE	VJ
Correlation	BA	1.000	.763	.217	-.184	.062	-.099	.019	.282	.166
	OPS	.763	1.000	.186	-.231	.021	-.040	.055	.112	.123
	MED BALL	.217	.186	1.000	-.485	.210	-.062	-.036	.225	.465
	HOME	-.184	-.231	-.485	1.000	-.386	-.140	.086	-.273	-.427
	FB	.062	.021	.210	-.386	1.000	.356	.233	.119	.084
	RCB	-.099	-.040	-.062	-.140	.356	1.000	.293	.010	.150
	LCB	.019	.055	-.036	.086	.233	.293	1.000	-.043	.027
	SE	.282	.112	.225	-.273	.119	.010	-.043	1.000	.321
	VJ	.166	.123	.465	-.427	.084	.150	.027	.321	1.000

Table 5. Classification Resultsa When Not Adjusting for Differences in Group Size

		Predicted Group Membership		
	ALL-STAR	Yes	No	Total
Original Count	yes	36	9	45
	no	4	19	23
%	yes	80.0	20.0	100.0
	no	17.4	82.6	100.0

a. 80.9% of original grouped cases correctly classified.

Table 6. Classification Resultsa When Adjusting for Differences in Group Size

		Predicted Group Membership		
	ALL-STAR	Yes	No	Total
Original Count	yes	37	8	45
	no	7	16	23
%	yes	82.2	17.8	100.0
	no	30.4	69.6	100.0

a. 77.9% of original grouped cases correctly classified.

non-All-Star. Finally, based on the population sampled, self-efficacy can differentiate between individuals that make their league's All-Star team and those who do not based on previous performance accomplishments. The discriminant function analysis seems better able to discriminate when a person should belong on the All-Star team as opposed to those who should not.

DISCUSSION

The present study was designed to examine differences in end-of-season success in Little League baseball based on physical, perceptual, and psychological variables as well as two end-of-season statistics (BA and OPS). The theoretical basis of this study was Dynamical Systems Theory which helps explain talent development within a multi-dimensional approach. Dynamical Systems Theory (Newell, 1986) suggests skill acquisition arises from an interaction between constraints within the organism, in the environment, and in the task (Summers, 2005) but no previous talent research study appears to exist based on multi-dimensional measures. Results of the present study found only left-handed curveballs (likely because a majority of the participants were right-handed), self-efficacy, and the two end-of-season statistics were significant at the .05 level. This shows that talent selection in youth baseball is a multi-dimensional process. Each league should collect BA and OPS throughout the season to aid in making objective All-Star selections. This may appear intuitive to most people but thirty-two participants were excluded from data analysis because BA and OPS were not collected.

Another practical suggestion for coaches would be to utilize the information provided in this study to determine strengths and weaknesses of players. If a coach knew what aspects of batting a child struggled with, the coach could provide remediation for that child to improve performance. By improving performance levels, self-efficacy would likely improve as well. Coaches could also improve self-efficacy beliefs of players by modifying tasks during practices to facilitate more mastery experiences. This change would be considered a task constraint in the Dynamical Systems Theory. By modifying the task the coach can facilitate a successful response.

CONCLUSIONS

In order to be accurate when selecting an All-Star roster, certain information should be collected in order for a league to make an informed and objective decision. Practicality should be the driving factor when applying the results of this research to selecting individuals for inclusion on the All-Star team. It appears critical for teams to collect information about season-long performance when selecting their All-Star roster. The collection of this information is not labor-intensive and would require someone to go through a scorebook at the end of the game and record information throughout the course of a season (usually includes about 15–20 games).

Coaches also should realize that despite the fact that physical variables lacked statistical significance, it is still important to be fit and strong. Nevertheless, physical variables should not be a determining factor when predicting the best baseball players. With that said, coaches should still provide sound physical training to their players as a function of making them better baseball players. The bottom line is that being able to hit a baseball is more important than having a great vertical jump (Everett, 1952). That may sound like an intuitive statement but youth coaches often make All-Star selections based on information that is not relevant to baseball performance throughout the season (32 participants in this study were excluding because season-long statistics were not collected).

There is still much work to be done when evaluating talent. The predictive accuracy of a model built with the Dynamical Systems Theory shows it is useful to examine talent through a multi-dimensional approach. However, practitioners need to further scrutinize this research to determine if the results are generalizable for the offensive variables. Researchers should also expand the testing to include fielding and pitching variables so as not to exclude that important aspect of the game when selecting individuals for inclusion on an All-Star team in youth baseball. ■

Notes

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