Going Beyond NCAA Bylaw 5-1-(j): Developing Learning Prescriptions for Student-Athletes

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Abstract

In recent years academic support programs for the student-athlete have become an integral component of athletic departments at major colleges and universities. This study reports the use of a test-scoring procedure called Modified Confidence Weighted-Admissible Probability Measurement (MCW-APM) to assist athletic department academic support personnel in diagnosing student-athlete knowledge gaps. A series of nine criterion-referenced tests (CRT) in fundamental knowledge-base areas of mathematics, language arts, and reading at the elementary, secondary, and junior college skill levels was administered to a group of freshmen student-athletes at UCLA. The MCW-APM test-scoring analysis generated specific learning prescriptions for each student-athlete along with information use-cognitive maps to indicate those knowledge-base areas where the student-athlete was informed, partially informed, uninformed, or misinformed. The learning prescription was then used by the tutorial program staff for developing an individualized instruction plan. Subsequent clustering of student-athletes by information type was used to design courses, workshops, and special programs with instructional objectives towards reeducation (for misinformed areas), instruction (for areas with lack of information) and review (for areas with partial information).

Introduction

The recruitment of "blue chip" student-athletes for college and university athletic programs has, especially in the last two decades, become a major and extremely expensive function of the modern athletic deparment. To a great extent the effectiveness of the recruiting process affects the visibility and financial success of the university's or college's athletic program. Once the student-athlete is "signed on" at a major college or university, strong efforts usually have to be made to ensure his or her retention in school, academic eligibility to compete in sports, and (ultimate) graduation. This enormous responsibility is usually assigned to personnel in the academic support division of an athletic department. Their function is to provide special classes, workshops, tutoring, counseling, and any other instructional support services required by the student-athlete. Because of visibility, athletic department academic support programs are most vulnerable to criticism from the general public, the university community, and the student-athletes themselves. When a student-athlete fails to graduate, drops out for academic reasons, or becomes ineligible to compete in sports, the reputation of the entire athletic program is suspect and the effectiveness of its academic support program is particularly scrutinized.

Function of Academic Support Programs

Academic support groups have become a critical element in college sports because of recent emphasis by the NCAA on the academic performance of the student-athlete. The passage of stricter NCAA legislation (Proposition 48, Bylaw 5-1-j-August 1986) will require an expanded administrative responsibility from athletic departments in the area of academic support.

Student-athletes who do not meet the initial eligibility criteria proposed in this new NCAA bylaw will be required to "sit out" the first year of college in order to "concentrate" on academics. There is an enormous need, therefore, to develop systematic methods for enhancing the effectiveness of academic support programs and assisting student-athletes to "concentrate" on academics. In essence, the mission of the sports coaches in an athletic department might be considered as developing the "human capital" of the athlete by refining his or her sports skills. The mission of the academic support program might be considering as increasing the "human capital" of the athlete by developing his or her cognitive skills. Academic support services have to first diagnose, then compensate for, poor educational backgrounds in order for the student-athletes to derive maximum benefit from the education they will be given in return for their athletic abilities. Many would argue that it is this latter human capital investment which should be of greatest importance to the student-athlete, because there is an extremely low probability of an athlete obtaining a professional sports career.[1]

Sociologists such as Harry Edwards have been especially critical of colleges and their athletic departments' behavior—especially with regard to black athletes (Edwards, 1983; Edwards, 1984). Edwards claims that athletically gifted students are pushed through the educational system with little or no regard for their learning needs and concludes that "dumb jocks are not born; they are systematically created" (Edwards, 1984, p. 8).

One of the major recommendations of Edwards, which formed the philosophical centerpiece for this research, was that

> Diagnostic testing should be made available to each student-athlete enrolled in order to determine academic weaknesses. Tutorial support should then be targeted to address these weaknesses (Edwards, 1984, p. 12).

How athletic departments can systematically accomplish this task in a cost-efficient manner poses a major problem for the academic support staff. Fortunately, computer technology can be used to assist academic support personnel in the diagnostic and remediation process.

Many student-athletes (not only black athletes, as suggested by Edwards), arrive at a college or university with significant amounts of misinformation (know academic concepts wrongly, e.g., $1/2 + 1/3 = 2/5$), lack of information (were never adequately instructed in certain academic areas), and partial information (were not fully instructed and evaluated in certain academic areas) in their knowledge base. To expect these academically ill-prepared student-athletes to compete on an equal footing with the general university community of students without significant affirmative resources from academic support is unrealistic and unfair to the university as well as the student-athlete.

What is proposed in this study is, therefore, an expanded role for academic support programs for student-athletes to include efficiently designed "affirmative" or proactive tutoring, in addition to class maintenance tutoring. Proactive tutoring is especially recommended for those athletes with particularly severe gaps in their knowledge base. It is not enough to provide student-athletes with a scholarship to attend classes and obtain an education without paying attention to limitations in their academic preparation. Students taking classes with gaps in their knowledge base will derive less than maximum benefit and enjoyment from their education. In short, building upon an incomplete knowledge base by attending classes is not only inefficient, but ultimately generates a negative overall attitude towards school. Imagine, for a moment, if football scholarships were awarded to the Julliard School of Music, and the student-athlete could not read music. The ability of the student-athlete to "get something out of" the free music education would be severely compromised. Affirmative tutoring, systematically and cost-efficiently designed into academic support programs, attempts to ensure that basic requisite elementary and secondary school

skills are being or have been met before the beginning of an undergraduate education. This will ensure that the intended promised educational experience will be effectively received by the student-athlete at a minimum overall cost to the athletic program.

Academic support personnel who use the norm-referenced SAT scores for insight into possible gaps in the student-athlete's knowledge base find them limiting and somewhat inappropriate. The SAT measures "scholastic aptitude," not specific cognitive skill areas. Additionally, it is norm-referenced to the distribution of many millions of college-bound students, not to any specific curriculum. The percentile breakdown of various SAT scores and the percentile ranking of a score of 350 or 700 as directed by NCAA Proposition 48 is depicted in Figure 1. Note that a score of 350 (or 700 combined) is at the sixth percentile, i.e., 94 out of every 100 college students who took the test scored higher. While this statistic might reveal something of the aptitude of the student-athlete relative to all students, it reveals very little in terms of actual achievement in special academic concept areas (e.g., do these athletes understand percentages, graph interpretations, fractions, etc.).

In short, it is of little value for academic support personnel to know that 94 out of every 100 students scored better on a test than the student-athlete. Remember, these test items are specifically designed to achieve the normal distribution or bell-shaped curve. (See Owen's *None of the Above*, 1985, for an excellent critical appraisal of the SAT.) It is far more productive for academic support personnel to measure specific academic concepts that should have been learned in elementary and high school, especially if these concepts form the basic knowledge-base skills required for undergraduate courses. Low percentiles as indicated by the SAT score might indeed indicate that major knowledge-base concept gaps exist from elementary and high school, but exactly *where* is problematic. Merely "concentrating" on academics without addressing these knowledge-base gaps will not, in the long run, benefit the student-athlete.[2]

Academic support staff have to go beyond the simple interpretation of the SAT to help the student-athlete prepare for academic work. It is essential that *all* student-athletes with scores below the 50th percentile be systematically tested in specific knowledge-base areas in order to diagnose and assess those specific areas requiring affirmative tutoring. With this type of prescriptive and diagnostic information, academic support personnel can then rigorously, systematically, and cost-efficiently begin to fill these academic concept gaps with affirmative tutoring and special workshops. Of course, some student-athletes will, because of good academic preparation, have only minor gaps in their knowledge base and will be able to compete effectively in academics as well as sports. Many student-athletes, especially those in football and basketball, will arrive at the university with varying

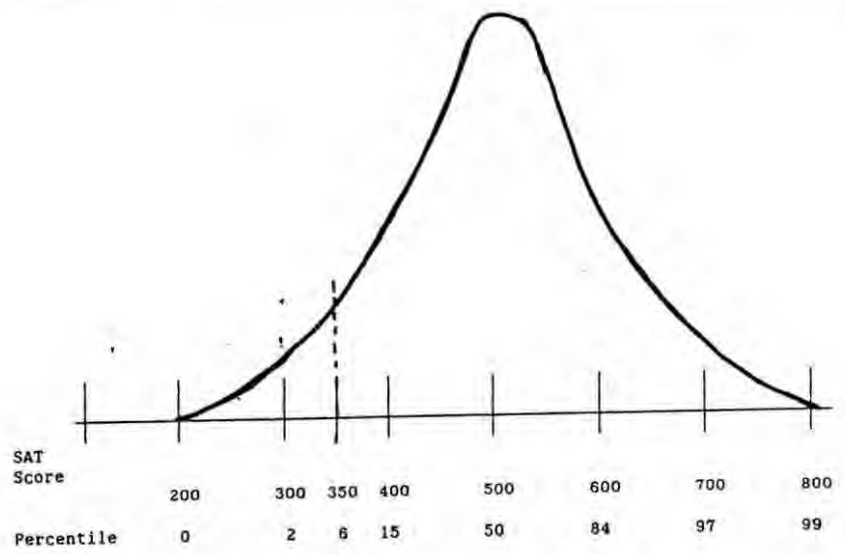

Figure 1
SAT Scores and Percentile Equivalents

configurations of knowledge-base deficiencies which will have to be diagnosed and have instructional remedies prescribed by academic support personnel.

Assessing the knowledge base of student-athletes entails two extremely different components—the test items depicting the academic concept areas to be evaluated and the proficiency level of the athlete in these cognitive areas. It is the latter of these components which is the principle concern and focus of this research—although the former is also of extreme importance. To accomplish this latter task a different way of scoring diagnostic assessment tests is needed. The research described in this study used a test-scoring system called Modified Confidence Weighted-Admissible Probability Measurement (MCW-APM)[3] (Bruno, 1986) to evaluate the student-athletes' performance (see figure 2 for response triangle). Students answered each question of each exam using the letters and associated confidence defined by the response triangle.

MCW-APM in Academic Support Progress

Twenty-one UCLA freshman athletes in the football and basketball programs were each given a series of nine criterion-referenced tests (CRTs), scored with MCW-APM, in the academic concept areas of mathematics, language arts, and reading in the elementary, secondary, and junior college

skill levels. Items used on the examination were derived from standard college texts and were considered representative of what would be "assumed" or "expected" by typical undergraduate courses (bar graphs, percentages, grammar, vocabulary, reading materials, etc.); i.e., they tended to form the academic concept foundation for a typical set of undergraduate courses at a college or university. The exams were then scored in MCW-APM format with a reward/penalty system relating the logarithm of the confidence in answer to a point score.[4]

The details of the MCW-APM test-scoring procedure were first described, with numerous testing examples presented, until each student-athlete was thoroughly familiar with all 13 response options to MCW-APM and their associated rewards and penalties (this procedure consumed about half an hour). All athletes began with the least difficult examination (elementary-level skills) and, depending upon mastery and information use, advanced to the more difficult (secondary), and then to the most difficult (junior college) skill levels over a three-day period. The student-athletes were able to finish each exam in 15 to 20 minutes. Approximately three hours, over a three-day period, were needed to complete the testing phase of the research. Separate testing in each of the three cognitive areas on separate days permitted student-athletes to advance to the next level in one area (such as math) but remain for further testing at the same skill level in another cognitive area (such as reading).

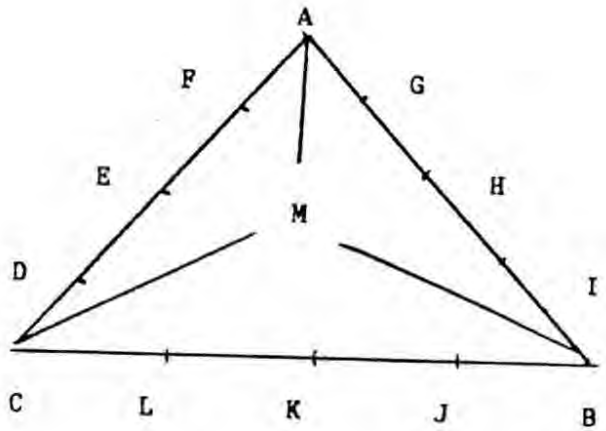

Figure 2
Modified MCW/APM Test Scoring Response Triangle

Illustration of a MCW-APM Analysis

For academic support personnel a MCW-APM test-scoring analysis is usually divided into three major parts. Part I is a detailed student information-use analysis and knowledge-base evaluation. This analysis forms the basis for the academic prescription which is later used by academic support personnel to generate an individualized learning plan for each student-athlete. Cost effectiveness is achieved by targeting tutorial resources to specific identified academic-concept areas where the student-athlete needs particular attention. Part II is a curricular evaluation based on the student-athlete's certain- and uncertain-information states. It is found by clustering examination areas by information type across all student-athletes who took the examination. This evaluation is used by academic support staff for planning workshops, specified lectures, etc. Part III is a summary class information-use profile which is found by clustering students by information type. This analysis is used to assign student-athletes to appropriate classes for enrichment, review, or reeducation. Parts I and III of the MCW-APM analysis are of particular significance to academic support personnel.

Output 1—The Learning Prescription

Part I of the MCW-APM analysis depicts the actual amount and type of information possessed by the student-athlete. It indicates specific knowledge-base areas where the student-athlete has information, misinformation, and lack of information. The learning prescription produced by this component of the MCW-APM analysis highlights "gaps" and especially indentifies those fundamental academic concepts where "misinformation" exists in a student-athlete's knowledge base. This type of information is extremely valuable for tutors as well as for the student-athletes since it forms the basis of the individual prescribed learning plan. It also indicates specific knowledge-base concepts that need reeducation because of misinformation and instruction because of lack of information. For misinformed concepts the tutor must show the student-athlete why one answer is wrong, then proceed to demonstrate why another answer is correct. For uninformed concepts only instruction is required.

Information concerning the way students value (overvalue or undervalue) their information when taking an examination is also measured with this part of the analysis. By examining the number of times a student-athlete uses an A, B, C response (the student indicates 100 percent certainty in an answer), and comparing this number with the actual number of these "certain" responses that were correct, the tutor can quantitatively assess how students value their information; i.e., it can form a quantitative measure of carelessness. Tutors can then approach their teaching tasks on two distinct levels: helping the student-athlete improve information use, critical thinking skills, etc., and addressing gaps in the knowledge base.

A typical learning prescription for a student-athlete with significant amounts of uncertainty or information is depicted in Figures 3, 4, and 5. Note the information-use cognitive maps and the learning prescriptions indicating knowledge-base areas targeted for reeducation, instruction, and review. Statistical information concerning the certainty and uncertainty in the knowledge base of the student-athlete is also presented. This information informs the tutor not just of the areas where the student is misinformed and informed, but also where there is strength or certainty in the knowledge base. It is readily apparent that this particular student-athlete will need much "affirmative" tutoring and instructional support, in addition to class maintenance tutoring, in order to have a successful undergraduate experience.[5]

Information Analysis

How Students Value or Undervalue their Information

MCW-APM Score .81

Expected Score .61

For items answered fully informed with A, B, C responses you should expect 100 percent of the responses to be correct.

Wrong	2
Correct	13
Total	15
PCT	.87

Figure 3

The Learning Prescription
(An athlete who has mastered elementary level mathematics.)

Output 3—Class Profile

Finally, student-athletes can be grouped or assigned to intensive review courses, workshops, or special lectures by their overall MCW-APM score and knowledge-base assessments. Those that have achieved mastery (MCW-APM score of 95 and above) can be assigned to an enrichment or advanced topics session; those whose MCW-APM score is between 85 and 94 can be assigned to review and basic instruction sessions. Finally, those whose MCW-APM score is below 85 (Figure 6) can be assigned to intensive instruction, reeducation, and review in remedial sessions. The class roll-book of student-athlete names for these sessions as well as the instructional objectives are also presented in this analysis. This component of the MCW-APM analysis gives the academic support program staff flexibility of

CW/APM Score 0.81

APM Score
- 95-100 Informed—Mastery—Advance
- 85-94 Well-Informed—Fair Mastery—Needs Review
- 76-84 Poorly Informed—Weak Mastery—Instruct
- 65-75 Little Information—No Mastery—Instruct
- 0-64 Misinformation in Knowledge Base—Reeducate

Information Use Score 0.87

Percent Time Correct When Using an A, B, C Response
(Indicates 100% Certainty in an Answer)
- 90-100 Good Information Use
- 80-89 Fair Information Use—Might Be Careless
- 00-79 Poor Information Use—Careless in Information Use

Expectation Score 0.61

Score if exam was taken many times using the APM probabilities and an R-W scoring system
Expected score with no partial information

Percent Overall Certainty in Information Base 0.50

Percent A, B, C Responses Used in Exam of the Total Possible Responses
- 80-100 Good Overall Certainty—Confidence in Answers
- 50-79 Weak Overall Confidence in Responses
- 00-50 Poor Overall Confidence in Responses—Exam out of Grade Level

Percent Correct Certainty in Information Base 0.41

Percent A, B, C Responses Which Were Correct of the Total Possible Responses
- 80-100 Good Correct Confidence in Responses
- 50-79 Weak Correct Confidence in Responses
- 00-50 Poor Correct Confidence in Responses—Exam Out of Grade Level

Percent Uncertainty 0.50

Percent D, E, F, G, H, I, J, K, L, M Responses of Total Possible Reflecting Partial Information of Uncertainty in Knowledge
- 00-10 Normal Uncertainty at Grade Level
- 10-20 Above Normal Uncertainty at Grade Level
- 21-100 Too Much Uncertainty—Exam Out of Grade Level

Figure 4

Modified MCW/APM Diagnostic Preparation
(weak student, elementary level mathematics)

Percent Lack of Information 0.25

Percent M or Blank Responses of Total Reflecting No Information or Lack of Time to Finish Exam
00-10 Normal Lack of Information for Grade Level
10-20 Above Normal Lack of Information for Grade Level
21-100 Too Much Lack of Information—Exam Out of Grade Level

Knowledge Base Areas of Misinformation—Reeducate

Measures-Oz	13
Mult-Mixed Fractions	25
Mult-Neg Num	32

Knowledge Base Areas with Lack of Information—Instruct

Fractions	4
Addition of Fractions	6
Num ID-Decimals	9
Circles-Radius	12
Comp-Distances	19
Graphs-Point	23
Graphs-Point	24
Fract-Decimal	28

Knowledge Base Areas with Partial Information—Review

Division 4x2	2
Measure Su Inch	14
Measure Yards	15
Graphs Point	22
Div-Fractions	26
Mult-Fractions	27
Percentage	29
Div-Decimals	31

Information and Cognitive Map of Knowledge Base

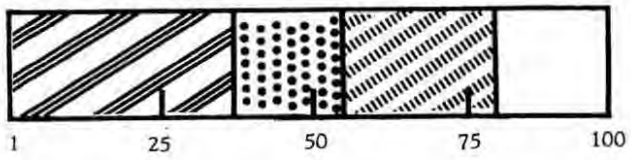

Figure 5

Areas of Misinformation and Information Use
Cognitive Map—Elementary Level Mathematics (weak student)

assigning "super" tutors or teachers to clusters or groupings of student-athletes so that their teaching talents can be shared and the limited resources of academic support used to maximum effectiveness.

Teacher Diagnostic Prescriptive MCW-APM Analysis for this Section

Grouping of Students by Information Use Maps and MCW-APM Analysis

This class has not achieved mastery, therefore, much basic instruction and review is needed.

Student Athlete	MCW-APM Score	Information Use Score	Trad. R-W Expectation Score
1	0.90	0.88	0.90
2	0.93	0.85	0.96
3	0.95	0.92	0.97
4	0.88	0.75	1.00
5	0.89	0.78	0.92
6	0.89	0.85	0.93
7	0.93	0.90	0.93
8	0.91	0.83	0.91
9	0.88	0.83	0.89
10	0.94	0.94	0.94

The number of students assigned to this section = 10.

This class was misinformed on these items:		Note frequency, reeducate in these areas:
Division 4x2	2	2.00
Fractions	4	2.00
No ID-Thousands	7	1.00
Circles-Radius	12	1.00
Measures-Oz	13	1.00
Measures-Sq Inch	14	2.00
Comp-Fractions	16	3.00
Graphs-Point	22	1.00
Graphs-Point	23	1.00
Graphs-Point	24	1.00
Mult-Mixed Fractions	25	3.00
Div-Fractions	26	1.00
Percentage	29	2.00
Mult-Neg Num	32	1.00

Figure 6

Selection to an Instruction and Review Session
in Elementary Mathematics

Summary and Conclusion

In summary, designing effective academic support programs for athletic departments requires the precise assessment, monitoring, and diagnosis of the entering student-athlete knowledge base. MCW-APM test-scoring methods permit the coordinators of the academic support program to develop specialized curricula for workshops and review courses in order to meet the specific classroom needs of entering student-athletes. Most importantly, this analysis provides "learning prescriptions" for each student-athlete and his tutor. This type of detail promotes a better individualization of instruction and a more efficient utilization of athletic department academic support tutorial resources. Because of the uniqueness and specificity of these learning prescriptions they also encourage the student-athletes to take a more "affirmative" approach to their own knowledge acquisition. Finally, the results of an MCW-APM analysis can be used to assist in counseling student-athletes to various courses and educational programs and for research into student behavior.[6]

Finally, the learning prescription, in coordination with an effective "affirmative" tutorial program to ensure that the prescription is filled, should assist academic support personnel to meet the desired objective of a successful college academic experience and graduation for each student-athlete. Ultimately, the development of the student-athlete's "human capital" via sports skills can be matched in the athletic department with the development of cognitive skills. Successful developments in both areas will enrich the student-athlete's entire life and ensure that the student-athlete derives maximum benefit from his scholarship and opportunity to obtain a college education.

NOTES

1. The odds of participating in professional sports have been estimated at 77 to 1 for basketball, 100 to 1 for football with an average professional life of four years (from "The Worst of Two Worlds," *Time Magazine*, Oct. 28, 1985, p. 76).

2. At the University of Georgia, only 17 percent of black football players and four percent of black basketball players earned degrees in the past ten years ("It's Cleanup Time for College Sports," *U.S. News and World Report*, July 1, 1985, p.58).

3. The scoring system used for these criterion-referenced tests is based on a Modified Confidence Weighted-Admissible Probability Measurement format, where the three choices for each exam question are referenced to a response triangle. Instead of the student merely answering A, B, or C, the student is presented with 13 response options (see Figure 2). The three vertices of the response triangle represent 100 percent confidence in either the A, B, or C choice. Letters on the response triangle halfway between A and B, or B and C, or C and A indicate .50 confidence in one of the two choices. Confidence levels at .25 and .75 are also assigned letters. A point at the center of the triangle represents equal confidence in all three choices, or confidence of A = .33, B = .33, and C = .33 (see Figure 2). The logarithm of confidence yields the point score for the item. A probability of 1.00 for a correct answer receives 31 points, a probability or confidence of 1.00 for an incorrect score receives a score of -100 points. Intermediate points, or confidence in a choice, is similarly awarded. Student-athletes are awarded points for all correct information and have points deducted for information known wrongly. No points are awarded or deducted if the student-athlete indicates "no information." For more details concerning MCW-APM test scoring see Bruno (1986).

4. MCW-APM test scoring scale is defined as:

	Award	Probability or Confidence	Appropriate Award for Communication
a *misinformed* answer is worth	-100	0.0	-100
a *random guess* is worth	-41	.08	-40
a *partially misinformed* answer is worth	-8	.25	-10
an *uninformed* answer is worth	0	.33	0
a *partially informed* answer is worth	+12	.50	+10
a *well-informed* answer is worth	+23	.75	+20
a *fully informed* answer is worth	+31	1.00	+30

The entire MCW-APM procedure is amenable to optical scanning using National Computer System (NCS) Sentry 3000 equipment.

5. ABACUS Educational Systems of Denver, Colorado, has incorporated MCW-APM into its Computer-Managed Instruction (CMI) System specifically designed for academic support and university-college counseling programs. This computer system, available on a microcomputer, provides tutors not only with activities and instructional sequences to "fill" the MCW-APM learning prescription, but additional test items to ensure that the prescription is filled. The ABACUS software is also designed to perform and instructional resource audit to ensure that learning materials, books, slides, aides, etc., are available to accommodate the learning prescription needs of the student-athlete.

6. Undergraduate introductory courses in mathematics and English can be used (with grades in these courses) to measure the effectiveness of the affirmative tutoring process. The research program at UCLA has also found that MCW-APM statistics, such as the percent score and information-use score, are powerful predictions of hours of tutoring needed the first quarter and first quarter grade point average. Research using MCW-APM statistics as predictor or explanatory variables in regression and discriminant analysis models looks extremely promising for use by academic support personnel.

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