VALIDITY AND RELIABILITY OF AN OBJECTIVE TEST OF CRICKET SKILLS

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ABSTRACT

This study was conducted to assess the validity and reliability of four self-designed, objective tests of cricket batting, bowling, fielding and general ability skills.

The batting test requires the batsman to hit a suspended ball at a target area as many times as possible in 60 seconds. His score is doubled to give his score for the batting test. In the bowling test the bowler is required to bowl ten balls at target areas marked on the pitch. Each delivery is recorded to give him a score out of 100. The fielding test requires the fielder to catch and field seven balls in a predetermined sequence. Each fielded ball that is not thrown through the target area incurs a penalty of three seconds. The total time taken is used to obtain the fielding test score out of 100. In the general ability test the player is required to hit a ball up and down twenty-five times. He then has to run along a predetermined path and field three balls and then bowl three balls at a target. A penalty of three seconds is added onto the time taken for each ball that does not pass through the target area. The actual score, out of 100, is determined from the total time taken.

To determine the validity of the objective tests of batting, bowling, fielding and general ability, 155 subjects were subjectively assessed in these four categories by experienced coaches. The four objective tests were then conducted on these subjects and the scores compared. Forty-four subjects were assessed by experienced and inexperienced testers to determine the reliability of the tests when administered by different testers. To determine the reliabliity of the tests when

repeatedly administered by one tester 23 subjects were assessed on five consecutive days. Significant correlations ($p < 0,05$) were found for the tests of validity between subjective and objective assessment (0,43 to 0,81) and the test for objectivity between experienced and inexperienced testers (0,41 to 0,78). A significant improvement ($p < 0,05$) in scores occurred during repeated testing, but most of this improvement took place between the first two tests.

The results indicate that the tests are valid and reliable tests of cricket batting, bowling, fielding and general ability, if sufficient pre-test practice is allowed.

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CHAPTER 1

INTRODUCTION

The conscientious coach spends a considerable amount of time and effort in developing skills, identifying talent and gaining knowledge of the potential abilities of his players. He has to beware of over-looking potentially good players who have not played the game, but who could develop rapidly under tutelage. In addition to selecting his team as fairly and successfully as possible, he must not neglect players with latent potentialities or retain players without these potentialities.

Evaluation of athletic skills where time, distance or height are accurately measured, to determine the results, provide no problem to the coach. In these sports the stopwatch or tape measure are used to assess the athlete's performance. However, in games where factors other than time and space are to be considered the coach is faced with the problem of accurately assessing who the better player is without the use of the stopwatch or tape measure. If the selection of the desirable from the undesirable is left to the judgement of the coach, it will obviously vary according to his ability in that respect.

Subjective evaluation in cricket, so necessary for the selection of teams, requires the coach to focus on the individual. He must compare what he sees to his own predetermined assessment of factors and skills that combine to make a successful player.

These observations would be based on his knowledge and experience as a cricket coach. Using this knowledge and experience the coach needs to determine whether the player has the technique, skill and mental attitude for the game. The coach must also assess how successfully the player would apply these in the game situation. When assessing the player, the coach would observe the execution of the technique while the player is practicing in the nets and try to analyse his strengths and weaknesses in order to predict the player's potential success in the actual match situation.

Cricket has never been a game in which accurate quantitative measurement of an individual's abilities have been made. In addition to subjective evaluation, a player's ability is often judged by comparing his batting and bowling averages to those of other players. However, a wide variety of factors make this an undesirable means of evaluating cricket ability or skill. This method does not take into account the standard of the opposition, the position of the match or the condition of the pitch. In batting, a player's average is determined by dividing the total number of runs scored over a period of time by the number of times the player was dismissed. If he was not dismissed then the runs scored in that innings would be included, but it would not be counted as an innings. This can result in a player scoring far fewer runs than another player, but by virtue of the fact that he was dismissed fewer times, his average could be far greater than the other player's.

It was for these reasons that the author set out to establish an

objective evaluative test of cricket playing ability. Tests such as these would enable the coach to select his team in a more objective manner. They would also enable the coach, when faced with a large group of players at the beginning of the season, to divide them into homogeneous groups. In addition, these tests would demonstrate to the young players how easy it is to evaluate their own performance. Such tests would provide easy and interesting methods, which require the minimum of apparatus, organisation and time, to practice the basic skills of cricket on their own. The feedback provided by these tests would act as a form of motivation to the players to improve.

Statement of the problem

1. To devise a battery of evaluative tests by which batting, bowling and fielding, as well as the general playing ability of cricket players, could be objectively assessed.
2. To assess the validity of these tests by comparison with subjective evaluations.
3. To establish the reliability of application of these objective tests.

Research hypotheses

The author hypothesized that:

1. The objective tests would assess, validly, the cricket ability of the players. In other words the cricket ability assessed subjectively would not differ significantly from the cricket ability assessed using the objective battery of tests.

2. The objective tests would be reliable when administered by various testers.

3. These tests would be reliable when repeatedly administered by one tester.

Statistical hypotheses

For each of the four tests, namely batting, bowling, fielding and general ability, the following null hypotheses (H_0) and alternate hypotheses (H_A) would be tested:

1. $H_0 \quad \mu_S = \mu_0$

$H_A \quad \mu_S \neq \mu_0$

where μ_S is the population mean result for the subjective evaluation and μ_0 is the population mean result for the objective evaluation.

2. $H_0 \quad \mu_1 = \mu_2$

$H_A \quad \mu_1 \neq \mu_2$

where μ_1 and μ_2 are population mean results for the first and second tests respectively.

$H_0 \quad \mu_E = \mu_I$

$H_A \quad \mu_E \neq \mu_I$

where μ_E is the population mean result for the experienced tester and μ_I is the population mean result for the inexperienced tester.

H_0 $\mu_{\text{Experienced x Application}} = 0$

H_A $\mu_{\text{Experienced x Application}} \neq 0$

where experienced refers to the level of expertise of the tester, and application refers to first or second time tested.

3. H_0 $\mu_1 = \mu_2 = \mu_3 \cdots \mu_r$

H_A $\mu_1 \neq \mu_2 \neq \mu_3 \cdots \mu_r$

where $\mu_1, \mu_2, \mu_3 \cdots \mu_r$ are population mean results of repeated administration on one group to a total of r treatments.

Delimitations

1. 52 players from Dale College, King William's Town, were used for the tests. In addition 13 players from Stutterheim High School and 24 from Selborne College, East London, were also used in this study. These players were all members of their school's first, second, third or under fifteen teams. They all received a minimum of three hours coaching per week.

2. The 110 primary school players used in this study were members of the Dale College Junior School (64) and two East London schools, Stirling Primary School (22) and Selborne College Primary School (24).

3. The boys used in this study were the best in their school or age-group. They all attend schools with long histories of producing top schoolboy, provincial and

international cricketers.

4. The author limited the tests to a test for each aspect of cricket: batting, bowling and fielding, as well as a test of general playing ability. A test for wicket-keeping was not included. It is such a specialist position and each team only requires one that the author felt that it did not justify a specific test.

5. The fourteen testers used to subjectively evaluate the players were the coaches of their respective teams. They were all experienced coaches. Of these coaches four had obtained the First Cricket Coaching Certificate of the South African Cricket Union and four had represented their province on the cricket field.

6. In the tests to determine the objectivity correlation coefficient, four coaches who had no prior experience in conducting sports skills tests were used as the inexperienced testers.

Limitations

1. Objective tests only evaluate the particular skill involved and do not measure the player's ability to adapt to various game situations. In a match a player is often required to make rapid decisions, with insufficient time to thoroughly evaluate the pros and cons of each situation. Various skills within each aspect of batting, bowling and fielding are required depending on the position of

the player in the team as well as the situation of the game. Unfortunately, objective skills tests are not able to evaluate these various aspects nor are they able to measure attitudes, motivation, personality or adjustment to stress. These factors all play a vital role in the match situation. Objective skills tests should be combined with a subjective evaluation to give an overall reflection of the player's ability.

2. The subjective evaluations by the coaches of the various teams are based on their opinion and personal judgement and would vary depending on their knowledge and experience in this regard. What the coach perceives may confuse his assessment since his observations and perceptions will be limited by his knowledge and experience. In addition, different coaches may perceive identical displays in different ways (Thomas 1978). Furthermore, personal preferences for style may result in the coach not seeing the effective outcome of the player being assessed.

3. The subjects used in this study were all schoolboy cricketers as it was not feasible to use top provincial and international players due to their heavy commitments during the season. As a result, players from the full range of ability levels, primary school through to provincial and national level, were not assessed.

4. The way in which various coaches interpret the instructions

and administer the objective tests may have a bearing on the results of the tests. Instructions for the administration of the tests were as free of ambiguities as possible.

5. Children are motivated to varying degrees and in various ways by testing and almost all want to do their best (Schurr 1967). The degree to which various coaches motivate the players may have influenced the results of the testing.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The review of related literature was divided into a section dealing with sports skills tests and a section dealing with cricket and cricket skills.

Sports skills tests

The Athletic Badge Tests of 1913 are generally regarded as the first sports skills tests (Collins and Hodges 1978, Johnson and Nelson 1979). They were devised by the Playground and Recreation Association of America and included the sports of volleyball, tennis, baseball and basketball. With a greater shift of emphasis to measurement and evaluation in Physical Education, the construction of sports skills tests accelerated after 1920 (Collins and Hodges 1978). During the 1930's sports skills tests became more sophisticated as scientific procedures developed. However, the need for standardised sports skills tests on a national level soon developed. This prompted the American Association for Health, Physical Education and Recreation to initiate a sports skills project in 1959 to determine the standards for five sporting activities (Collins and Hodges 1978, Johnson and Nelson 1979). The construction of national sports skills standards could have influenced independent investigators because many new sports skills tests were developed during the 1960's (Collins and Hodges 1978). Since then many quality tests, covering a wide variety of sports, have been constructed by various individuals and organisations. They aimed at promoting the use of sports skills tests

in sport and physical education. In addition a wide variety of measuring instruments, from the simple metre-stick to complex electrical equipment, have been used in the various tests.

Johnson and Nelson (1979) warn of the dangers of complacency and discouragement in the establishment of new tests as no research efforts have been reported in some areas for the past twenty or thirty years. They believe that we should continue to seek new methods of measuring the traits which we have had some success in measuring. A concerted effort should also be made to assess those qualities which previously have not been measured.

Clarke (1976) believes that the use of measurement is one of the most distinctive marks of the professional viewpoint. However, no testing project should be undertaken unless it is part of a clearly defined educational policy. Measurement allows the tester to determine the status of a person with reference to a particular quality measured. This allows comparisons to be made with other groups and progress can be measured by comparing the results to previous tests (Clarke 1976).

Sports skills tests play an important part in the teaching of physical education and in the coaching of sport. The potential, achievement and progress made by the pupils may be evaluated using sports skills tests (Clarke 1976, Collins and Hodges 1978, Johnson and Nelson 1979). This can allow pupils to be equated and placed into homogenous ability groups without the coach

first having to observe their performances at a number of practice sessions (Clarke 1976, Collins and Hodges 1978, Franks and Deutsche 1973, Johnson and Nelson 1979). Skills tests can assist the coach to diagnose the performance levels of his pupils and to detect any weaknesses in their performance (Collins and Hodges 1978), specific needs of the individual (Johnson and Nelson 1979) or to pinpoint his strengths and weaknesses (Franks and Deutsche 1973). With the competitive element inherent in the structure of sports skills tests it allows pupils to compare themselves to others, as well as to their previous scores. When used correctly they may serve to motivate pupils to improve performance and to progress (Collins and Hodges 1978, Franks and Deutsche 1973, Johnson and Nelson 1979). With the establishment of national norms pupils can compare themselves to other pupils of their age (Johnson and Nelson 1979).

Skills tests may be used by a teacher or coach to interpret the programme to parents and administrators (Collins and Hodges 1978, Franks and Deutsche 1973), to evaluate his methods of instruction, the strengths and weaknesses of the programme (Johnson and Nelson 1979), the relative values of sport activities in terms of meeting and fulfilling the desired objectives (Clarke 1976, Franks and Deutsche 1973, Johnson and Nelson 1979) and in curriculum planning (Franks and Deutsche 1973, Johnson and Nelson 1979).

Verducci (1980) classifies the use of measurement into student-, teacher- and administration-related areas. Student-related

uses include determining objectives, predicting future performance, directing programmes, classifying, individualising learning situations, motivating, developing skill, determining improvement, determining achievement and grading. Teacher-related uses include determining the effectiveness of teaching methods and adjusting course content to suit the needs of the pupils. Evaluating the curriculum and developing community interest are included under administrative-related uses.

Skill acquisition plays a major role in physical education programmes (Campbell and Tucker 1967). However, the ability to co-operate and co-ordinate with team members, as well as the social, intellectual and emotional state of the individual all play an important role in team games. All these factors should be considered and the ultimate assessment of a player's ability should only be given after these non-physical factors have been subjectively assessed (Campbell and Tucker 1967).

Johnson and Nelson (1979) believe that performance in team sports is sometimes more difficult to determine than in individual sports. They suggest that sports skills can successfully be used for grading players provided that they are carefully combine with a subjective evaluation of the player's actual performance. Baumgartner and Jackson (1975) claim that subjective evaluation needs to be valid, reliable, economic in terms of time and as objective as possible. In addition a rating scale is needed to pin-point the components of skill being tested.

Subjective evaluation takes many forms. It is used by all coaches and teachers and necessitates a reliance on training and experience (Franks and Deutsche 1973). They suggest that the evaluator decides on the various components to be evaluated and uses a rating scale to assess the player. The evaluator must focus on the player with predetermined criteria in mind for the rating of the degree of skill attained . Only one skill should be rated at a time.

If subjective evaluation is done during the match situation then three observations, under similar environmental conditions, should be done on each player (Franks and Deutsche 1973). They are of the contention that between three and five raters should be used for subjective evaluation in research projects. After the first judgement the raters should consult and standardise their techniques.

The norm-referenced method of assessment involves the comparison of a player's score to that of a set of norms based on players of the same age, sex and ability levels (Hardman 1978, Johnson and Nelson 1979). In the criterion-referenced method of assessment the player is judged against a predetermined set of criteria. These criteria may be selection for a team or the degree to which a player has competence (Hardman 1978, Johnson and Nelson 1979). However, Hardman (1978) suggests that this method is unfair as there are only a limited number of positions in a team, no credit is given for the skills learnt by the players who do not make the team, and team selection is biased by the teacher's understanding of the game and the

degree to which the pupil fits into that understanding.

Thomas (1978) explains that what the coach observes and perceives may confuse his assessment. The picture that he perceives from any display may be perceived in different ways by different coaches. Personal preference for style may result in the coach not seeing the effective outcome.

For sports skills tests to be acceptable to coaches and physical educationists they must meet a number of criteria. These criteria include validity, reliability, objectivity, ease with which the tests may be administered, availability of norms and economic factors. The more of these criteria that each test meets the better the test will measure the desired skill.

A sports skill test is said to be valid when it measures the skill or skills it was designed to measure (Campbell and Tucker 1967, Clarke 1976, Collins and Hodges 1978, Baumgartner and Jackson 1975, Eckert 1974, Franks and Deutsche 1973, Johnson and Nelson 1979). Campbell and Tucker (1967) are of the contention that validity is the most important criterion to consider when constructing a test. Irrespective of whether the test meets the other criteria, if it does not test what it was designed for, it is a useless test. Validity of sports skills tests is assessed by determining the relationship between the score obtained in the new test and an established criterion that equates well with the quality being measured by the new test. The most common test criterion in sports skills measurement are subjective ratings of experts and tournament rankings (Collins

and Hodges 1978). However, Eckert (1974) states that the use of subjective evaluations are only as good as the knowledge and judgement of the raters. Clarke (1976), Collins and Hodges (1978) and Eckert (1974) agree that there are other means of validating a new test. Logical or face validity, when the test requirement is the same as the skills required in the specific sport, is the most acceptable type of validity. Composite scores, based on several tests, can be used to determine the correlation coefficient with the new test. Further validation can be done by comparing the scores obtained in the new test to those obtained in a previously validated test. However, this method is dependent on the previously validated tests and therefore has the strengths and weaknesses of the previous validity criterion and validation process (Eckert 1974). Validity of a new test can also be determined by critical appraisal by experts who analyse the activity in terms of the fundamental elements required in the specific skill to be measured (Clarke 1976).

Validity is normally expressed as a coefficient of correlation. If a high correlation exists between the two scores then it may logically be concluded that the test is a valid test of that particular sports skill. Cohen and Holliday (1979) are of the contention that a correlation of below 0,20 is a very low or negligible relationship, between 0,20 and 0,40 is a low correlation, between 0,40 and 0,70 is a modest to substantial relationship, while above 0,70 is regarded as a high to very high correlation. Baumgartner and Jackson (1975) believe that a validity coefficient of between 0,70 and 0,85 is acceptable for sports skills tests. Campbell and Tucker (1967) state that the degree of validity

demanded before a test is acceptable, will depend to a large extent upon what the test sets out to measure. The more subjective the character to be measured, the lower the accepted coefficient of validity would be. Clarke (1976) states that a low correlation between the new test and the criterion against which it was measured indicates that little value can be attached to the tests unless there are extenuating circumstances. These extenuating circumstances may be that the criteria measures used were inaccurate or that the new test may still be somewhat inaccurate. However, the new test may still be superior to any other available methods.

A test is said to be objective if the test is administered to a group of subjects by different testers and similar results are obtained (Campbell and Tucker 1967, Clarke 1976, Collins and Hodges 1978, Eckert 1974, Franks and Deutsche 1973, Johnson and Nelson 1979). Campbell and Tucker (1967), Clarke (1976) and Collins and Hodges (1978) are of the contention that objectivity is a more stringent test than reliability. They believe that a test will only be objective if it is reliable. However, the converse is not true as a tester may make the same mistakes consistently and would thus obtain a reliable result. The second tester, on the other hand, may conduct the tests correctly thus obtaining a lower coefficient of objectivity than the first tester.

A high degree of objectivity depends on the standardization of testing techniques and procedures, the ease and simplicity of administration and measuring procedures (Campbell and Tucker 1967, Clarke 1976). Furthermore, the reduction of the results

to a mathematical score and the correct training, supervision and accuracy of the testers will increase the objectivity of the tests. The tester must ensure that his instructions are clear and concise, allow practice trials and keep the level of motivation as constant as possible (Clarke 1976).

Objectivity may be expressed as a coefficient of correlation between the results of two tests, conducted by different testers, on the same group of subjects. Campbell and Tucker (1967) believe that the objectivity correlation coefficient should be 0,90 or above. Clarke (1976)(p. 27) sets out his generally accepted objective standards as follows:

0,95 - 0,99	very high, found among the best tests
0,90 - 0,94	high, acceptable
0,80 - 0,89	fairly adequate for individual measurement
0,70 - 0,79	adequate for group measurement, but not satisfactory for individual measurement
0,60 - 0,69	useful for group averages and school surveys, but entirely inadequate for individual measurement

The reliability of any test is the degree to which it is repeatable on the same group under similar circumstances (Campbell and Tucker 1967, Clarke 1976, Collins and Hodges 1978, Baumgartner and Jackson 1975, Eckert 1974, Franks and Deutsche 1973, Johnson and Nelson 1979). Highly reliable tests reveal similar scores when admistered a second time to each subject. A reliable test is not necessarily a valid test as the measurement of a quality other than that which the test is intended to measure may produce consistent results

when repeatedly administered. However, a valid test, administered correctly, invariably shows a high degree of reliability (Collins and Hodges 1978).

The reliability of a test can be determined in different ways. The test - re-test or stability method requires the tester to test the same group of subjects twice and to compare the scores. However, systematic changes are not accounted for using this method resulting in a greater chance of deviation in performance and a lower reliability correlation coefficient (Collins and Hodges 1978, Eckert 1974, Franks and Deutsche 1973, Johnson and Nelson 1979). Using the split-halves method the tester establishes a reliability correlation coefficient by comparing the scores of all the even numbered subjects to those of the odd numbered subjects for the same test. Similarly the first half of the scores can be compared to the second half of the scores, of the same test, to give a reliability correlation coefficient (Baumgartner and Jackson 1975, Collins and Hodges 1978, Eckert 1974, Johnson and Nelson 1979). The comparable forms or equivalence method of testing for reliability is used to test for the reliability correlation coefficient of written tests. Two similar tests are drawn up and administered to one group of subjects and the correlation coefficient derived from the results (Baumgartner and Jackson 1975, Eckert 1974). Using the internal consistency method of testing for reliability, the subjects perform the new test twice on one day. There should be no decrease in scores after the first trial due to fatigue.

Reliability is usually expressed as a coefficient of correlation between the results of the two tests. Collins and Hodges (1978) recommend that a minimum reliability coefficient of 0,80 be used for test items scored on the basis of distance. A minimum coefficient of 0,70 was recommended for skills scored on the basis of accuracy and form by the Sports Skills Test Project of the American Alliance for Health, Physical Education and Recreation (Collins and Hodges 1978). Campbell and Tucker (1967) recommend a reliability coefficient of at least 0,90.

Baumgartner and Jackson (1975) report that Zuideman lists four important factors affecting reliability. The testers must ensure that the subjects are of hetrogeneous ability, well motivated and clearly informed about the nature of the tests. Each test should be long enough and repeated often enough for each subject to show his best performance. Thirdly, the tester must ensure that the organisation and testing environment are favourable to good performance. Lastly, a competent tester is more likely to achieve a higher degree of reliability than an incompetent one. Reliability depends on the ease and simplicity with which the tests can be administered and the accuracy and impartiality of the tester's procedures (Campbell and Tucker 1967).

Feldt and McKee (1958) found that a number of factors were responsible for daily differences in skill performances during skills testing. Differences in day-to-day fatigue condition, bodily health, mental attitude and the level of motivation were

all factors which they found lowered the reliability of a test.

To enable the tester to compare the performance of subjects it is important to establish a set of norms (Campbell and Tucker 1967, Franks and Deutsche 1973). Norms are mean figures representative of a specified population and computed from as large a sample as possible (Campbell and Tucker 1967, Clarke 1976, Johnson and Nelson 1979). The norms should be constructed from the same population as the subjects to be tested. Any difference between the two populations should be taken into account when testing (Campbell and Tucker 1967, Clarke 1976, Johnson and Nelson 1979).

A scoring scale based on absolute performance (e.g. percentiles) is not very successful as the scores tend to crowd around the mean. Scales based on standard deviation values of the normal distribution (e.g. Z-scores, T-scores, Sigma-scale, Hull-scale) are more successful as a more even spread of scores is obtained (Clarke 1976).

In addition to the above criteria there are other factors to consider when determining the scientific authenticity of a test. The test should lend itself to administration in a reasonable amount of time and should be easy to administer and score (Campbell and Tucker 1967, Collins and Hodges 1978, Johnson and Nelson 1979). The preparation time prior to the testing of a group of subjects should be minimal (Collins and Hodges 1978). The time required by the subjects and the

testers should be used as economically as possible (Clarke 1976). The cost of the equipment should be kept as low as possible otherwise it may discourage the use of the test (Campbell and Tucker 1967, Johnson and Nelson 1979). The equipment should be standard for the sport or easily accessible (Collins and Hodges 1978). A further consideration is whether the test can be used as a drill during practice sessions. Besides enabling the players to practice the skills during their normal practice session, it will save time when explaining the testing procedure (Johnson and Nelson 1979).

Campbell and Tucker (1967) and Johnson and Nelson (1979) drew up a number of steps to follow when constructing a new test. Firstly, the game must be analysed to determine the fundamental skills required and which skills need to be measured. Test items, which measure the desired qualities, should be selected and the exact procedures for administration and scoring of the test should be determined. Having done this the validity, reliability and objectivity of the test is assessed. Once the tester is satisfied that the test meets with these criteria then the final test instructions and procedures are carefully prepared and a set of norms are constructed.

Before administering a test it is important that the tester tests the accuracy of the equipment to be used and that all the testers are familiar with the equipment, testing procedures and scoring systems to be used (Baumgartner and Jackson

1975, Campbell and Tucker 1967, Johnson and Nelson 1979). The subjects must be familiar with the test items, understand the instructions, be allowed to warm-up, practice the tests if necessary and be well motivated (Baumgartner and Jackson 1975, Johnson and Nelson 1979). After the tests, the test scores must be analysed and the results interpreted (Baumgartner and Jackson 1975, Johnson and Nelson 1979). The subjects should be given some form of feedback as to how they achieved.

Clarke (1976) suggests that about ten percent of the time set aside to teach and coach a sport should be used for the testing of the specific activity or sport. This should develop from a gradual beginning and build up as the programme develops. However, tests are essentially the means of measurement and should not constitute the programme itself but rather fit into a well-prepared scheme of work.

One of the major drawbacks of sports skills tests is that the best test can become meaningless when administered by an incompetent tester (Johnson and Nelson 1979). A further limitation is that in the actual game situation a second person may significantly influence the performer's execution of the skill, while in many tests the influence of a second person is eliminated (Johnson and Nelson 1979). Sports skills tests should not be the only criteria for assessing players' skills as they only take into account the factors required to perform the test (Hardman 1978). The coach should observe the player's skills in a match situation to

gain a deeper insight into how the player thinks and operates (Hardman 1978). The test results should also be combined with a subjective evaluation of the student's skill performance to give a good indication of the player's actual ability level (Johnson and Nelson 1979).

Campbell and Tucker (1967) are of the contention that old established tests should be modified and perfected rather than constructing new tests.

Many sports skills tests, some more successful than others, have been constructed and administered through the years in order to objectively assess sports skills. These tests have varied from team games to games for individuals, contact to non-contact games, physical to non-physical games, and games requiring strength, speed and skill.

Eckert (1974) indicates that several basic formats appear frequently in sports skill tests. Some tests require the application of maximal force and/or accuracy of projection of an object. Other tests require the controlling of objects directed towards the individual, while other tests require speed of body movement while controlling an object.

McGraw and Tolbert (1952) found that the best of three attempts was the most acceptable method for use in sports skills tests. The use of three attempts facilitated the administration and scoring of the tests. Stroup (1955) found that the use of ten-minute game results as a criteria

for validating a team sport test was accurate. Eighty-four percent of the games were correctly predicted using scores from objective tests of passing, dribbling and shooting ability of basketball players.

Certain measures of strength and structure were used to accurately measure success in the baseball skills of hitting, running, throwing, fielding and over-all baseball ability (Hookes 1959). Osborne and Gordon (1972) found that instructors were more accurate in identifying movements that were performed correctly than those which were incorrectly performed. No significant differences in the overall accuracy of ratings could be linked with either the skill of the instructor or feedback.

A larger amount of time is spent by the coach in his efforts to obtain a knowledge of the potential abilities of his players in order to select a team fairly and successfully. However, often players with latent potentialities are overlooked. Hardman (1978) suggests two methods of assessment of sports skills. The first method, the norm-referenced method, involves the assessment of the player's score which is then compared to a set of norms to enable the coach to compare the different players. In the criteria- referenced method performance is judged against a predetermined set of criteria such as selection for a team, which he either achieves or fails to achieve. However, this method is unfair as there are only a limited number of positions in a team, no credit is given

for the skills learnt by the players who failed to make the team, and team selection is biased by the teacher's understanding of the game and the degree to which the pupil fits into that understanding (Hardman 1978). Personal preference for style may result in the coach not seeing the effective outcome (Thomas 1978).

Through continual assessment the coach can avoid making inaccurate impressions of the players' ability and their level of achievement. The development of attitudes and values can be monitored, while individual and team differences and readiness to learn new skills can be assessed. Assessment is also useful as it provides the players and coach with useful feedback regarding performance and organisation (Hardman 1978).

The game of cricket

Historical records show that a form of cricket, called 'creag', was played as early as the rule of Edward I in the thirteenth century (Tyler 1975). From these humble beginnings has developed a game which has prospered in countries throughout the world. With the greater publicity received as a result of financial sponsorship, limited-overs cricket and night-cricket, far more spectators and players have been attracted to the game. Vast sums of money have been spent on improving the equipment and playing facilities. Unfortunately very little scientific attention has been given to the players who, after all, are the ones who attract the spectators. Previously administrators, coaches and players have based their theories concerning training and coaching on hunches, beliefs, the

practice of successful players, and trial and error.

Cricket is played between two sides of eleven players and gives the maximum opportunity for combining team effort with individual skill and iniative. Besides a sound basic technique, which is essential for success in cricket, there are a number of other factors which differentiate between the average and the successful player who is able to score runs, take wickets, hold catches and field consistently. These factors are discussed in the ensuing paragraphs. The more of these aspects that a player possesses the more likely he is to succeed as a player.

In batting the batsman's score is determined by the number of times he runs from one end of the pitch to the other, and by the number of boundary fours and sixes he hits. When a batsman is dismissed, his place is taken by another, and so on until ten batsmen have been dismissed or the innings has been declared closed. When the first side has completed its innings, the other side takes theirs. The ability to visually pick-up the flight of the ball early after it has been released (Walker 1978) and the ability to judge where it will bounce (Walker 1978, Arlott and Trueman 1977) are important characteristics for success in batting. Miller and Whitington (1953), Arlott and Trueman (1977), Pollock and Pollock (1968) and the M.C.C. Cricket Coaching Book (1976) regard fast reactions essential to become an outstanding batsman. Miller and Whitington (1953) and Sheppard (1975) regard co-ordination of eyes, mind, feet and hands as

an important aspect of batting. A further characteristic for success in batting is that the player must be well balanced at all times when executing his strokes (Walker 1978, Arlott and Trueman 1977) and must distribute his weight into the right place at the right time (Arlott and Trueman 1977). A further hallmark of great players is the time which they have to play their shots and the ability to time their strokes correctly, thus hitting the ball in the gap rather than hitting the ball with tremendous force (Arlott and Trueman 1977, Sheppard 1975, Pollock and Pollock 1968).

Bland (1969) regards the drive off the front foot while batting as the basic scoring shot in cricket. The M.C.C. Cricket Coaching Book (1976) states that "the player who cannot drive (off the front foot) is only half a batsman" (p. 84). Greig (1974) explains that batsmen can practice their driving techniques on their own by placing a cricket ball in an old stocking suspended from a tree branch or beam so that the ball is about 30cm off the ground and then hitting it straight with an upright bat. In addition to being a form of practice, this also teaches the player the importance of playing straight strokes in the arc between mid-off and mid-on (straight past the bowler), especially early in his innings.

A bowler from the fielding side bowls an over of six balls from one end of the pitch to the batsman defending the opposite wicket. He either attempts to bowl fast to intimidate

the batsman thus forcing him to play a false stroke, or uses spin, swing or flight to bring about the batsman's downfall.

A bowler needs co-ordination of trunk, arms and legs to achieve the vital rhythm which is so essential to bowl accurately (M.C.C. Cricket Coaching Book 1976, Pollock and Pollock 1968, Sheppard 1975, Willis 1978). The ability to control the accuracy of the flight of the ball while bowling, resulting in a delivery of good length and direction, is also considered to be a pre-requisite for success in bowling (Arlott and Trueman 1977, Bland 1969, M.C.C. Cricket Coaching Book 1976, Miller and Whitington 1953, Pollock and Pollock 1968, Walker 1978).

Many of the great bowlers of the past used very simple, yet effective means of developing and practicing their accuracy of length and direction. Focusing on the spot where the ball should pitch, and not on the batsman, is a common technique used by bowlers to improve their accuracy (Sheppard 1975). Willis (1978) states that all fast bowlers in first-class cricket have, at some time or other, had to improve their accuracy by bowling at a mark on the pitch. This is done without a batsman at the receiving end so that the bowler may concentrate on his accuracy and not on dismissing the batsman. Willis (1978) and Greig (1974) advocate that a bowler should practice by bowling at a mark on the pitch and a set of stumps in order to improve his length and direction.

The fielding side is classified into those fielding close to the wicket and those fielding in the outfield. They assist the bowlers in preventing the opposing batsmen from scoring runs and in dismissing them by acting swiftly and knocking over his wickets while he is attempting to complete a run or by catching him out.

Graeme Pollock (Pollock and Pollock 1968) believes that a good fielder needs to be a safe catcher of the ball, be a quick mover who is able to anticipate well and must possess a fast and accurate throw. Bland (1969) supports this belief that a fast and accurate throw is a pre-requisite to becoming a good fielder. He is of the opinion that 90% of all run-outs come from distances of between 10 and 40 metres. Greig (1974) encourages young players to practice fielding on their own by throwing a ball against a wall and catching it as it rebounds.

In the survey of the literature, the shortage of Cricket Skills Tests becomes obvious. The tests found will be briefly discussed in this section.

Proficiency Award Scheme (Sutcliffe 1975)

This test is divided into four sections: batting, bowling, fielding and wicket-keeping (Appendix G, p. 131). The batting test consists of three graded tests. In the first test the subject has to choose three strokes, in the second test five strokes and in the third test six strokes are chosen from a possible eight strokes. Depending on the

stroke, the ball is either dropped or thrown by a bowler or server. It is recommended that a tennis ball be used for the batting test. The batsman has the choice of playing the following strokes: pull, cut, on-drive, straight drive, off-drive, cover drive, lofted drive and the drive off the back foot. The batsman is given five attempts at each stroke of his choice and scores a point for each ball hit between two markers ten metres apart and placed, in the appropriate position, at a distance of twenty metres from the batsman.

The bowling test comprises of three graded tests. Each bowler bowls two overs of six balls with the best over to be counted. The bowler has to bowl the ball with an overarm action at a target on the pitch (Appendix G , p. 131) Once the ball has pitched it must hit the wickets. Points are scored for hitting the target and the wickets, which both become smaller as the tests become more advanced. A degree of subjectivity is also introduced in the two more advanced tests as one point is scored if the ball swings or spins.

The fielding tests are made up of catching, retrieving and intercepting. In the first test one point is scored for each successful catch made. In the second test the fielder has to retrieve and throw five balls through a two metre target (Appendix G , p.131). For each successful throw three seconds is deducted from the time taken. The score in points is then read off from a table. The final test is similar to the previous test except that the fielder has to intercept and throw five balls at a one metre target placed

at either 10 metres, 15 metres or 20 metres.

The wicket-keeping test consists of three graded tests. Each test involves the wicket-keeper standing up to the wicket, standing back from the wicket and running up to the wicket to take a return from a fielder.

The Test of Cricket Ability (Stretch 1983)

In the batting test a 156 gram leather ball is balanced on a tee approximately 15 cm off the ground. A plastic fruit juice bottle was used in this study. Six stumps are placed in the ground 25 metres away from the ball (Appendix B, p. 114). The six stumps are placed in the ground in a straight line with A being 0,71 metres (1 stump length), B, C, D and E being 1,42 metres (2 stump lengths) apart. A scorer is required to observe between which wickets the batsman hits the ball using a cricket bat, and to record the score. The batsman must take up his normal stance behind the ball. He then steps forward and hits the ball as he would hit a straight drive. He must aim to hit the ball between the stumps. If he hits the ball through A he scores 10 points, through B or C he scores 6 points and through D or E he scores 4 points. Any balls that pass outside of the stumps do not score any points. If a ball strikes a stump and does not pass through then it is counted as having passed through and the batsman receives the higher score. Each batsman is given ten attempts, to give him a possible score out of 100.

A 156 gram leather ball is used for the bowling test. The target areas are marked off on the pitch (Appendix B, p. 114). A scorer is required to observe in which target area the ball pitches, and to record all ten scores on the score sheet. The bowler may bowl over or round the wicket with an over-arm action. It is essential that he bowls as he would in a match or at practice. He delivers ten balls, aiming at the target areas on the pitch. If the ball pitches in the smaller area he scores 10 points and if it pitches in the larger area he scores 6 points. Any ball that pitches outside of these areas would score 4 points. If the ball pitches on a boundary line of a target area then it is counted as a good delivery for the inner area (i.e. the higher score).

In the fielding test six 156 gram leather balls are placed at points B, C, D, E, F and G (Appendix B, p. 114). The scorer holds a seventh ball, a stopwatch and the score card in his hands. He positions himself in such a way that he will be able to see whether the fielded balls have passed through the target area and to reconstruct the target area quickly if it is knocked over. The target area consists of two stumps placed in the ground so that a third stump may be balanced on top of them. The ball is allowed to bounce before passing between the stumps. The fielder stands at position A. The timekeeper throws a ball approximately 10 metres into the air so that it comes down as close to the fielder as possible. He catches the ball and returns it to the target area as quickly as possible. The timekeeper

begins timing once the ball touches the fielder's hands. If the fielder drops the ball he has to retrieve it while the timekeeper continues timing. Having returned the first ball he now turns and returns the ball at B. He then returns the balls at C, D, E and F, in that order, once again using the over-arm throw. From F he runs in, picks up and returns the ball at G with an under-arm throw. Having done this he sprints past the target area. Once he crosses the line at the target area the timekeeper stops his watch and reads off the time in seconds. A left-handed fielder would move from B to E, F, C, D and G, in that order. The scorer records the fielder's time to the nearest second. For each throw that did not pass through the target area, and for a dropped catch, a penalty of three seconds is added on to the time taken to give the total time taken. This time is then subtracted from 100 to give a score out of 100.

The totals for the batting, bowling and fielding tests are added together and converted to a percentage which can be used to classify the player by comparing the percentage obtained to the given standards.

When the players were evaluated subjectively (Stretch 1983) for batting, bowling and fielding the mean scores, out of a possible 100, were 58,2, 63,1 and 65,8 respectively. This gave a mean score of 62,2 for over-all cricket playing ability. The objective evaluation gave mean scores of 57,6, 67,8 and 65,9 for batting, bowling and fielding respectively and a mean score of 63,6 for over-all cricket playing ability.

The findings revealed significant correlations ($p < 0,01$) of 0,71 for batting, 0,79 for bowling, 0,67 for fielding and 0,57 for over-all cricket playing ability when the objective and subjective ratings were compared.

Although cricket has been played for centuries few scientific studies have been conducted on cricket players, particularly expert performers. Abernethy (1981) considered the differences between highly skilled and lesser skilled cricket batsmen in terms of the temporal parameters of viewing time, latency time and movement time. He found that hightly skilled batsmen were able to produce more accurate shot-selection decisions from shorter viewing time than less skilled players. The highly skilled players were able to utilize advance information more effectively and make more efficient use of the available mechanism for determining ball direction and velocity.

Movement time is the actual duration of the response from the time the movement is initiated until the movement is completed (Whiting 1979). In a laboratory study of batting type situations which required the subjects to step forward or backward in different directions as in the actual playing situation, a more or less constant movement time in the region of 0,3 seconds was found (Whiting 1979). It can be concluded that if the reaction time to a visual stimulus is in the region of 0,2 seconds, then a time of 0,5 seconds is necessary to initiate and complete the stroke. Even for a ball bowled at a very low velocity (16,09 km/h) the stroke

will have to be initiated when the ball is 2,29 metres away (Whiting 1979). For a ball bowled at 128,75 km/h the batsman, standing 18,29 metres away, would only have 0,51 seconds to play the stroke. For a ball delivered at 96,56 km/h he would have 0,68 seconds to play the stroke, while for a ball bowled at 64,37 km/h the batsman would have 1,02 seconds to play the stroke. Reaction time tests conducted on Don Bradman, regarded as one of the world's greatest batsmen, at Adelaide University showed that his reactions were slower than the average for his age. These findings prompted Robinson (1975) to speculate that Bradman's success lay in his co-ordination of eyes, mind, feet and hands.

Penrose et al (1976) used a high speed photosonic camera with telephoto lens to record the release velocities of fast bowlers during a cricket test match. Release velocities of up to 159 km/h (44,17 m/s) were recorded. At this velocity the batsman only has 0,483 seconds to perceive the ball, predict its course, decide upon a stroke and execute the stroke. These authors report that Williams states that it takes approximately 0,6 seconds for the batsman to perceive the ball and then to play it. Thus a batsman's reaction has to be initiated 0,162 seconds prior to a ball being released at a velocity of 159 km/h. A camera at the batting end showed that a rather drastic drop-off in velocity occurred as the ball hit the surface of the pitch. The speeds at the batting end were on an average of 22,69km/h slower than the release velocities.

Davis and Blanksby (1976 a) conducted a cinematographic analysis of fast bowling and biomechanically analysed the run-up, delivery, follow-through and velocity of the ball to identify factors common to fast bowling performance. They found the most common delivery sequence for fast bowlers to be:

(a) non-bowling arm begins extending,
(b) rear foot is planted on the ground,
(c) bowling arm is vertical with the hand pointing downwards,
(d) non-bowling arm is horizontal - anterior to the body,
(e) bowling arm is horizontal - posterior to the body,
(f) front foot is planted,
(g) non-bowling arm is vertical with hand pointing downwards,
(h) rear foot is lifted from the ground,
(i) bowling arm is vertical with hand pointing upwards, and
(j) the ball is released.

In a second project Davis and Blanskby (1976 b) studied the segmental components of fast bowling to determine the relative contribution made by certain body parts to fast bowling. They isolated various body parts so that their importance to the bowling action could be measured. They concluded that to bowl a cricket ball at speed, the run-up contributes 19,5%, leg action and hip rotation 23%, trunk flexion and shoulder girdle rotation 11%, arm action 41% and hand action 5,5% of the total ball velocity. They also concluded that a run-up of 14 paces is sufficient for bowling up to 37 metres per second or 133,6 km/h.

Cooke (1955), Lyttleton (1957), Start (1962) and Daish (1972) agree that the Reynold's number with its critical value, the two forms of boundary layer and the effect of spin all play a part in a bowler being able to swing the ball through the air. The Reynold's number affects the speed above which a cricket ball will not swing. The speed of a ball bowled varies up to about 45 metres per second. Once the ball slows down, due to air resistance, to below the critical Reynold's number of around 33 metres per second, it will begin to swing. If the surface is roughened, by the seam or by the bowler shining one side of the ball on his clothing to keep it smooth and neglecting to shine the other side, then the boundary layer becomes turbulent. This is due to the Reynold's number exceeding the critical value. As such it is possible to have an air flow which is different on the two sides of the ball. Such an asymmetrical flow will produce a sideways force causing the ball to swing. A very small disturbance in the balance of pressures on either side of the ball is needed to swing a cricket ball (Daish 1972). Slow bowlers in cricket achieve swing by spinning the ball about a vertical axis as opposed to the normal delivery which would be spun about a horizontal axis. This is caused by the Magnus effect which results when a spinning ball moves through stationary air. This can be increased if the surface of the ball is rough so that the air is more easily dragged around it (Daish 1972).

Passmore and Durnin (1967) found that the energy expenditure for young cricketers bowling slowly was 7,5kJ/min, while for

batting it was 13kJ/min. Fletcher (1955) found that bowlers, with a body mass of less than 65kg, had an energy expenditure of 20 - 33,5kJ/min and that batsmen utilized 20 - 29,3kJ/min.

Summary

Besides a sound basic technique a player needs as many of the following aspects as possible to be a successful cricketer:

1. Batting
   (a) The ability to visually pick-up the flight of the ball early after it has been released and to judge where it will bounce,
   (b) fast reactions,
   (c) co-ordination of eyes, mind, feet and hands,
   (d) correct balance at all times when executing the strokes and the distribution of the body weight into the right place at the right time,
   (e) time to play the strokes, and
   (f) the ability to time the strokes correctly thus hitting the ball in the gap rather than hitting the ball with great force.

2. Bowling
   (a) The bowler should have the necessary co-ordination of trunk, arms and legs to achieve rhythm,
   (b) control of the ball, and
   (c) accuracy of length and direction.

3. Fielding
   (a) The fielder should be a safe catcher of the ball,

(b) be a quick mover who is able to anticipate well, and

(c) possess a fast and accurate throw.

CHAPTER 3

METHOD

It was decided to use as few tests as possible as it was the author's contention that the greater the number of tests, the more difficult it would be to organise and test the players. As a result, fewer coaches would utilize the tests. The batting, bowling and fielding tests described in this chapter, are relatively static tests and as a result a fourth test, of general cricket playing ability, was included in an attempt to cater for other dynamic aspects. This would enable the coach to obtain an even deeper insight into the capabilities of the players tested. The apparatus and administration of the four tests was kept as basic as possible, and apparatus that was readily available to all coaches was used.

To conduct the test, the apparatus was set out as required. The coach then divided the players into four groups and each group was given a score-sheet and allocated a test where they would begin. Before commencing the coach described the correct procedure for each test as well as the scoring and recording procedure for each test. Before the commencement of each test the players were given a brief period to warm-up, as would be done before a practice or game, to ensure optimum results and to prevent injuries. On the command to begin the four groups started simultaneously. The coach moved from one group to the next ensuring that the tests

were carried out correctly. Once all four groups had completed their first test they rotated in a clockwise direction. This continued until the players had been to all four tests.

The following apparatus was required:

16 leather cricket balls (156 or 135 grams)
1 ball in a sock,
nylon twine to suspend the ball (± 2m),
2 bats,
6 stumps,
3 stopwatches,
score sheets and pencils.

Batting Test

Many young cricket players are familiar with the idea of suspending a ball in a sock, from a branch of a tree and practicing their batting in this way. The drive off the front foot was chosen as the stroke to be played as it became evident from the literature that it forms the basis of a good batsman's technique (Bland 1969, M.C.C. Cricket Coaching Book 1976). A target area through which the ball had to be hit was chosen as timing and placement of the ball in the correct place, rather than hitting the ball with tremendous force, is vital for a batsman to score runs regularly (Arlott and Trueman 1977, Sheppard 1975, Pollock and Pollock 1968). The importance of playing the ball in the arc between mid-on and mid-off (straight back past the bowler), especially early in the innings, is vital for success in batting (Greig 1974). In the test, as the ball swings back

the player needs fast reactions and co-ordination of eyes, mind, feet and hands to position himself correctly to play the next stoke. One session of 60 seconds was chosen as the the period for batting and the score obtained was doubled to give a score of 100.

In the batting test a 156 gram leather ball was placed in a sock suspended by thin nylon twine approximately 15cm above the ground. The stumps are placed 0,71m (1 stump length) apart and 1,42m (2 stump lengths) from the suspended ball. The batsman took up his position at the crease 0,71m (1 stump length) from the suspended ball. The scorer, with a stopwatch, took up his position next to one of the stumps. On the command to begin the batsman stepped forward and hit the ball with a straight bat. He aimed to hit the ball so that it would pass between the stumps and swing straight back to him. He continued to hit the ball, with his back foot behind the crease, as it swung back to him. A point was scored for each ball that passed between the two stumps as it swung away from the batsman. A point was not scored if the player's back foot was not behind the crease when he struck the ball. Each player batted for one session of 60 seconds. The score the batsman obtained was entered on the score sheet by the scorer and multiplied by two to give the total score out of 100 for the batting test. The better the batsman the greater should be his score.

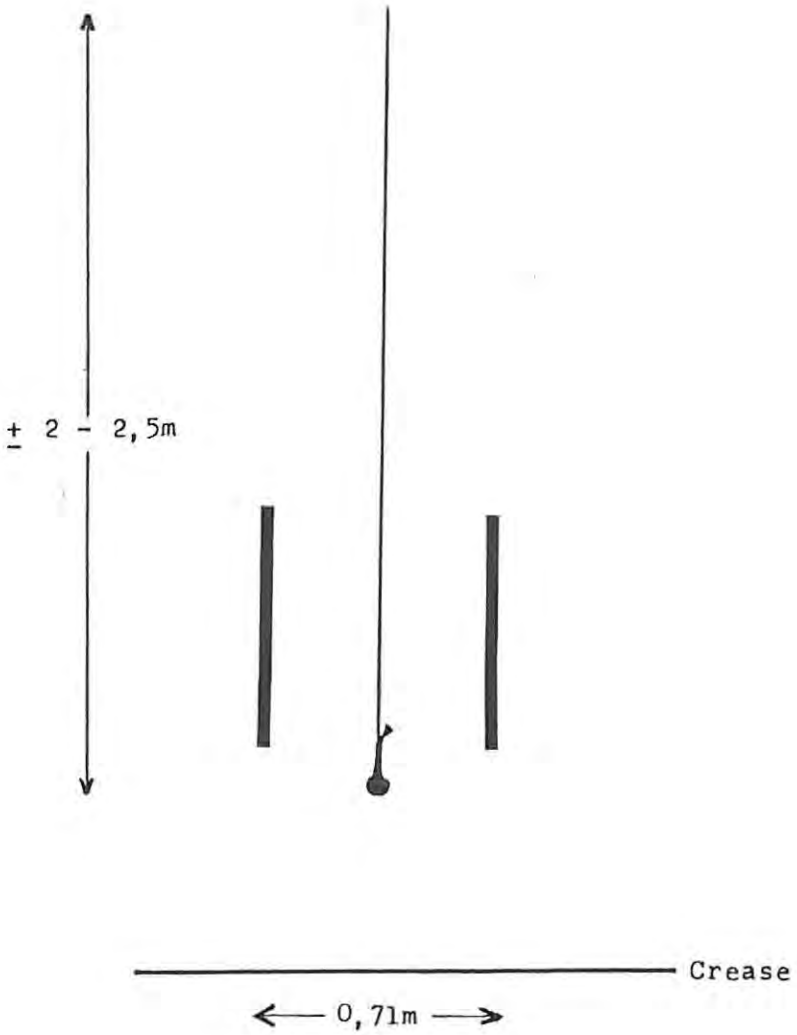


Figure 1: Plan for the setting up of the apparatus for the batting test (front view).

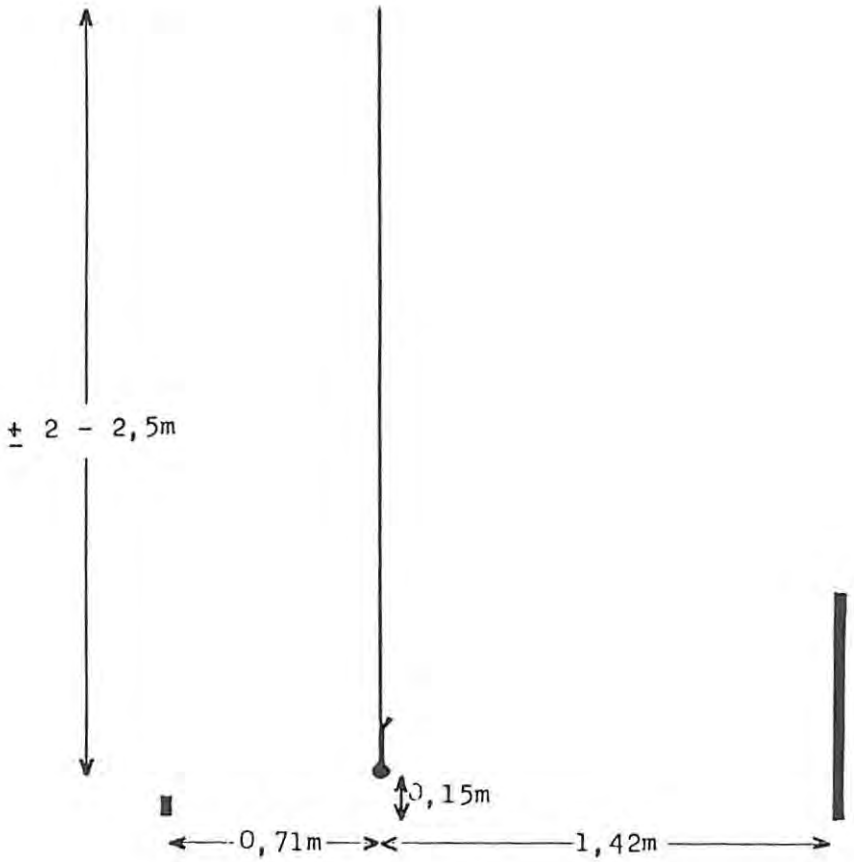


Figure 2: Plan for the setting up of the apparatus for the batting test (side view).

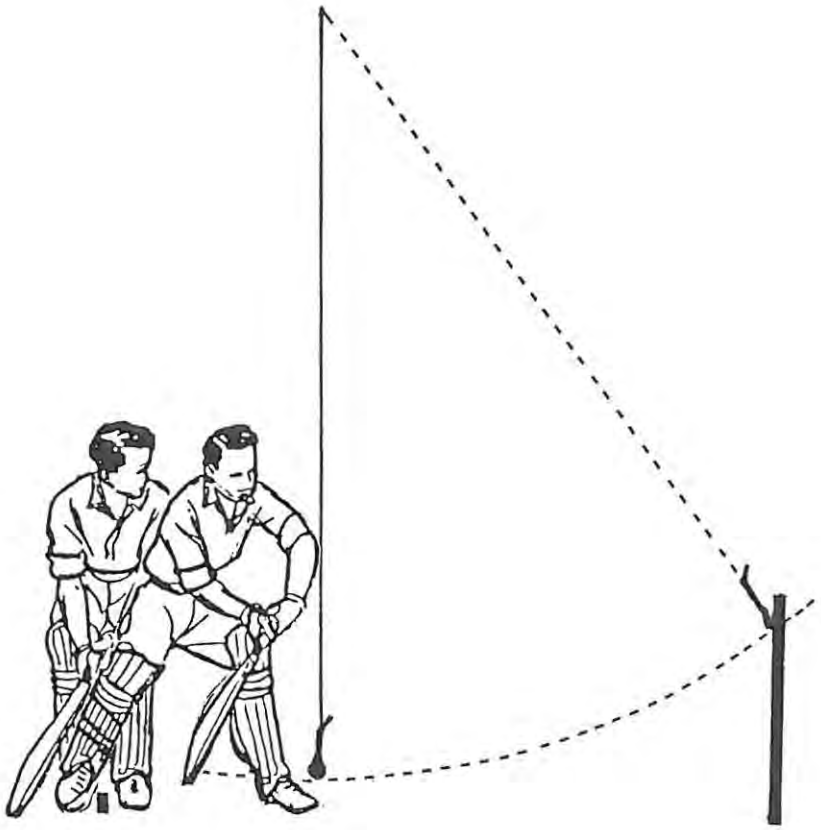


Figure 3: Diagram illustrating how the batsman plays the ball in the batting test.

Bowling Test

In the bowling test, target areas were chosen as this was a common method of practicing accuracy of length and direction (Willis 1978, Greig 1974). Smaller target areas were chosen for the slow bowlers as they require greater control of length and direction as they deliver the ball at a slower velocity thus allowing the batsman more time to take advantage of an inaccurate delivery. The test does not require the bowler to bowl at a batsman thus allowing him to concentrate on bowling accurately and not on dismissing the batsman. Each bowler was required to bowl ten deliveries, with a maximum score of 10 for each, thus giving a score out of 100. In addition he must bowl as he would in a match thus making the test as close to actual match conditions as possible.

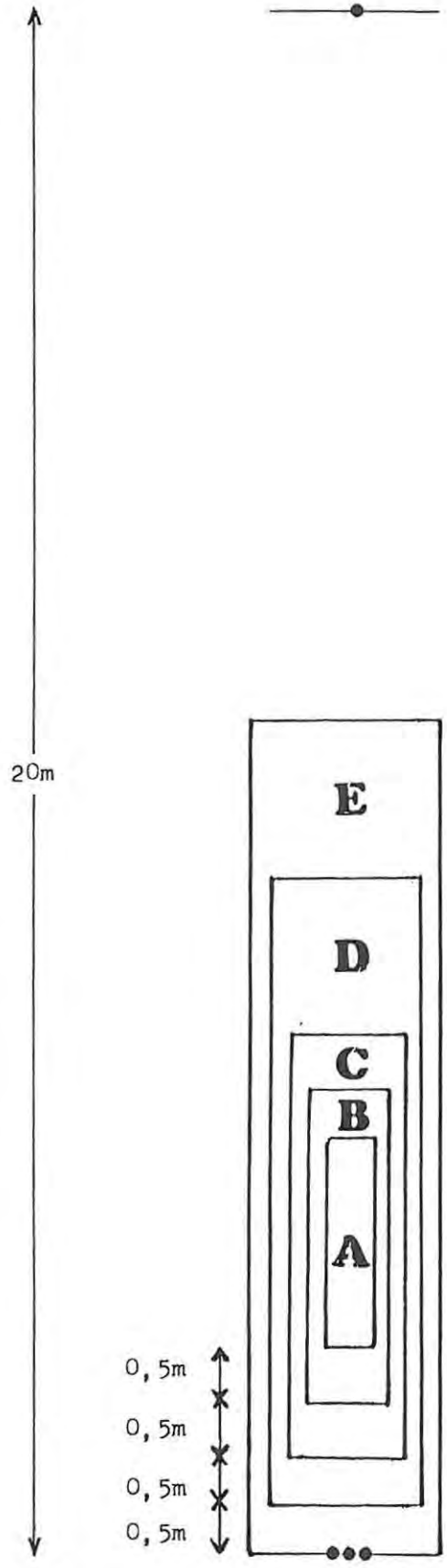
A 156 gram leather ball was used for the bowling test, while for the junior players a 135 gram leather ball was used. The target areas are marked off on the pitch as shown in Fig. 4 (p. 48). On a turf wicket the areas can be marked off using a length of string and four nails for each target area. On artificial pitches these areas can be marked off with white chalk or again using string which is stuck down at the corners using Prestik. To facilitate the testing a mat was used with the target areas marked off on it. A scorer is required to observe in which target area the ball pitches and to record the scores on the score sheet. The bowler may bowl over or round the wicket with an over-arm action. It is essential that he bowls as he would in a match or at practice.

The bowler delivered ten balls aiming at the target area on the pitch. Any ball pitching on the boundary line of the target area was counted as a good delivery to the inner section (i.e. the higher score). Points were scored for each ball pitching in the target area or boundary line as shown in Table I.

Table I: Target areas in which slow and fast bowlers score points.

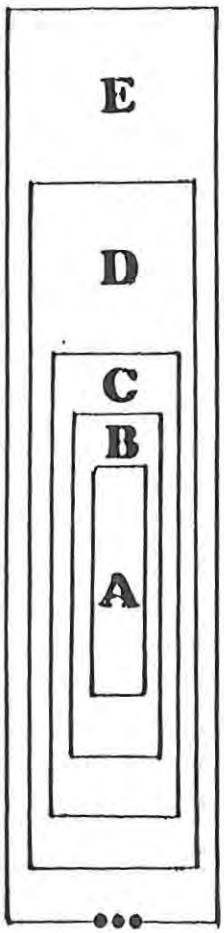
Target area	Slow Bowlers	Medium and Fast Bowlers
A	10	10
B	8	10
C	6	8
D	4	6
E	2	4
Outside E	0	2

The bowlers in the group bowled alternately, and recorded the score after each delivery. The total score that the bowler obtained for the ten deliveries was his score for the bowling test. The better the bowler, the greater should be his score.



A = 0,40m x 2m
B = 0,75m x 3m
C = 1,10m x 4m
D = 1,45m x 6m
E = 1,80m x 8m

Figure 4: Plan for the setting up of the apparatus for the bowling test.



A = 10 points
B = 10 points
C = 8 points
D = 6 points
E = 4 points
Outside **E** = 2 points

Figure 5: Diagram illustrating the target areas for the fast bowlers.

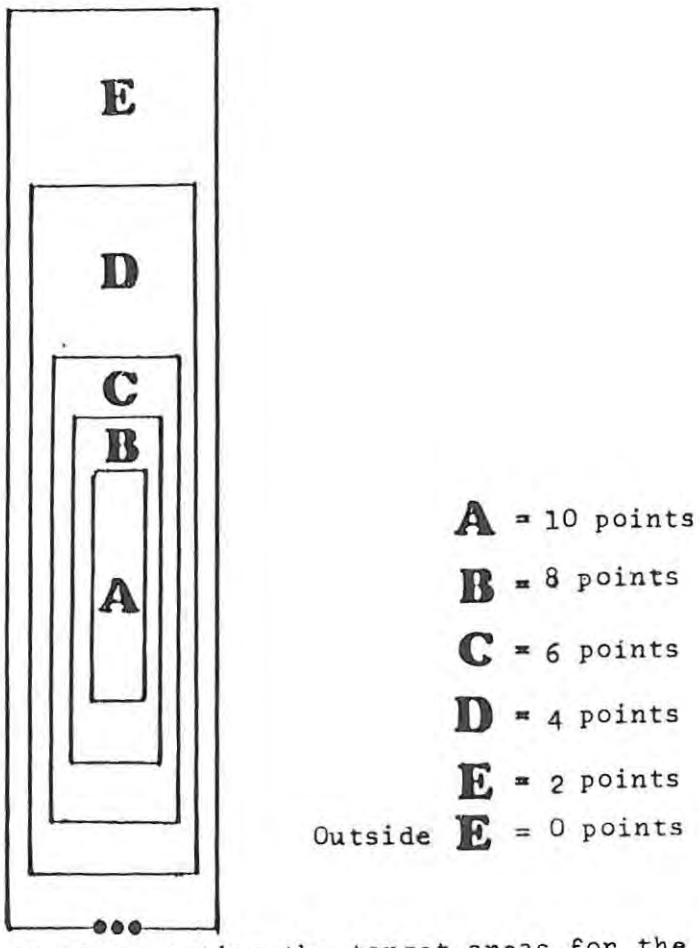


Figure 6: Diagram illustrating the target areas for the slow bowlers.

Fielding Test

In the fielding test the distances vary from between 10m and 35m as the majority of run-outs occur between this distance (Bland 1969). If the fielder does not catch the ball when it is thrown to him, or for each throw that does not pass through the target area, he is penalised three seconds. This maximum penalty incurred would total 21% of the score and was included as it was felt that a fielder should be a safe catcher of the ball and should possess a fast and accurate throw if he wishes to be a successful fielder (Bland 1969, Pollock and Pollock 1968). The time taken by the fielder to complete the test is also recorded as a fielder has to move swiftly, pick up the ball and throw it at the stumps quickly in order to dismiss a batsman by running him out (Bland 1969, Pollock and Pollock 1968). Stationary balls were used as it eliminated any subjectivity of a second person rolling balls to be fielded. The prescribed path the fielder had to follow forced him to pick up balls as he approached them from different directions, as he would encounter in a cricket match.

In the fielding test six 156 gram (senior players) or 135 gram (junior players) leather cricket balls were placed at B, C, D, E, F and G as shown in Fig. 7 (p. 53). These points should be marked with lime or a bean bag to ensure that the balls are placed in the correct place each time. The scorer held a seventh ball, a stopwatch and the score card in his hands. He positioned himself in such a way that he would be able to identify whether the fielded balls had

passed through the target area and to reconstruct the target area quickly if it was knocked over. The target area consisted of two stumps placed in the ground 0,71m (one stump length) apart. If the ball knocked the stumps over the scorer reconstructed the target area while the fielder continued. The ball was allowed to bounce before passing between the stumps.

The fielder started at position A. The timekeeper threw a ball approximately 10 metres into the air so that it came down as close to the fielder as possible. He caught it and returned it, using an over-arm throw at the target areas as quickly as possible. The timekeeper began timing once the ball touched the fielder's hands. If the fielder dropped the ball he had to retrieve it while the timekeeper continued timing. Having returned the first ball he now turned and returned the ball at B. He then returned the balls at C, D, E and F, in that order, once again using the over-arm throw. From F he ran in, picked up and returned the ball at G with an under-arm throw. Having done this he sprinted past the target area. Once he crossed the line at the target area the timekeeper stopped his watch and read off the time to the nearest second. A left-handed fielder would move from B to E, F, C, D and then G, in that order. The scorer recorded the time. For each throw that did not pass through the target area, and for a dropped catch, a penalty of 3 seconds was added on to the time taken to give the fielder his total time taken. The better the fielder the shorter should be the total time taken. The fielder's actual score was then obtained by refering to Table II (p. 61).

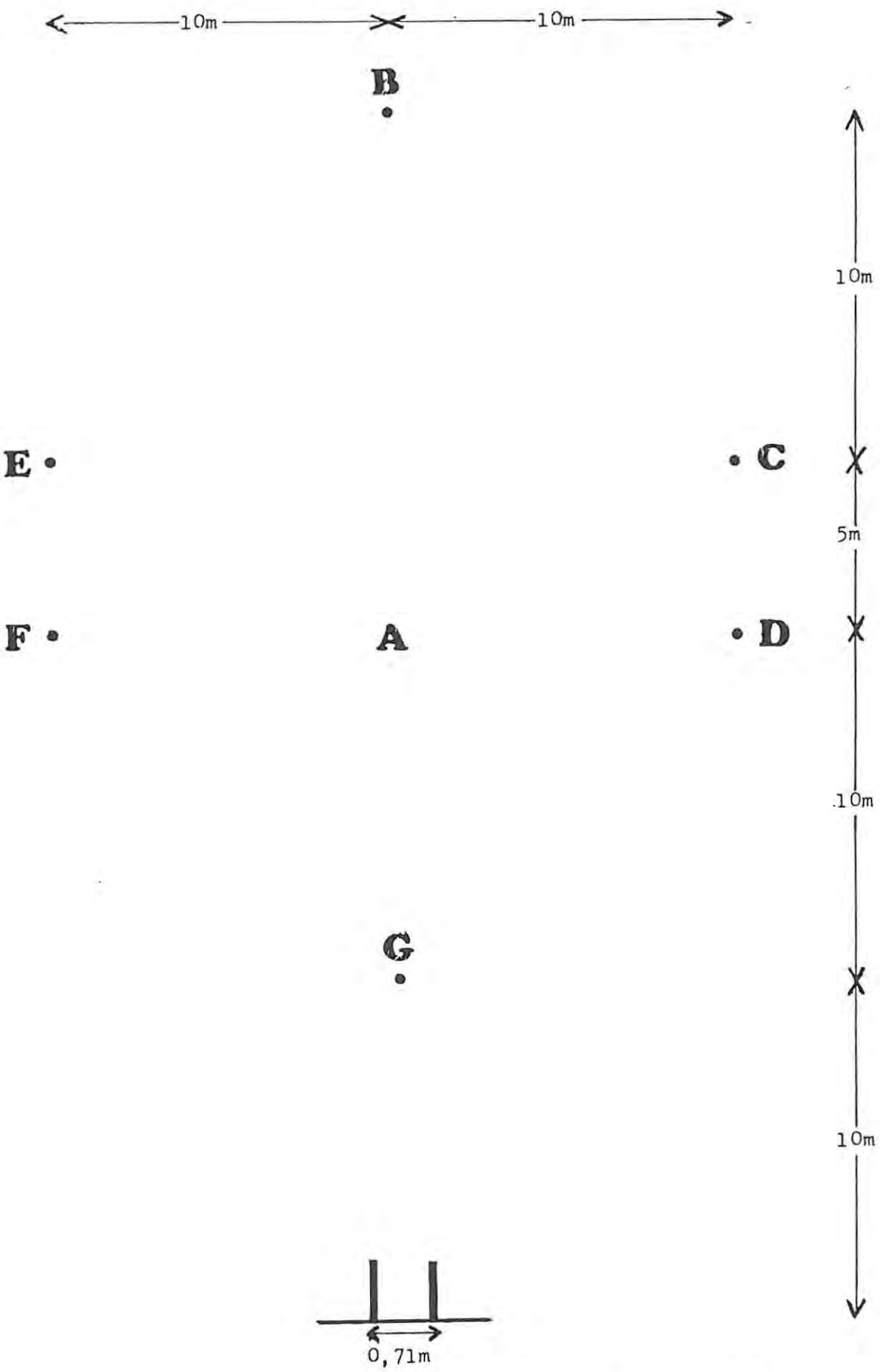


Figure 7: Plan for the setting up of the apparatus for the fielding test.

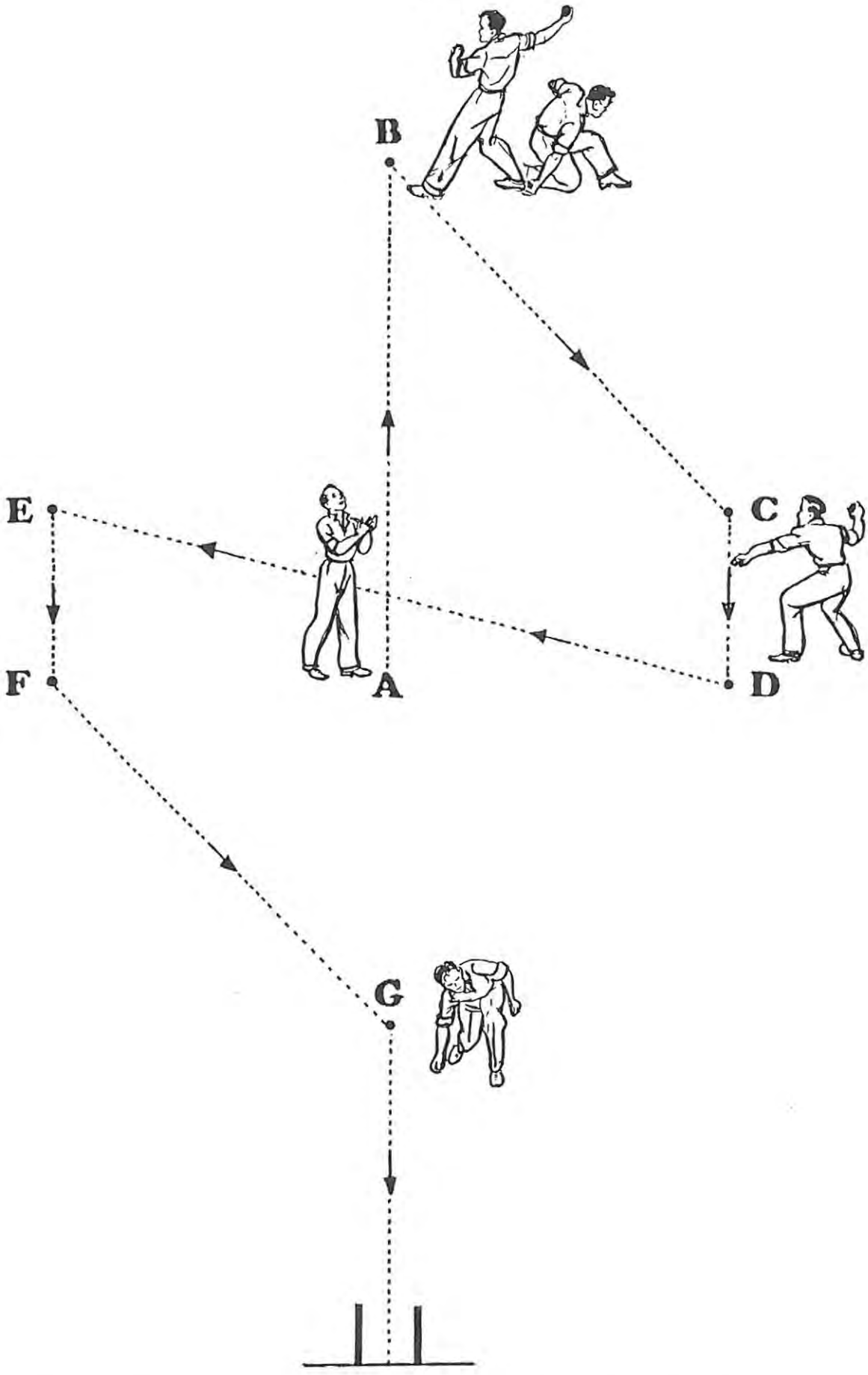


Figure 8: Diagram illustrating the path to be followed by a fielder who throws right-handed.

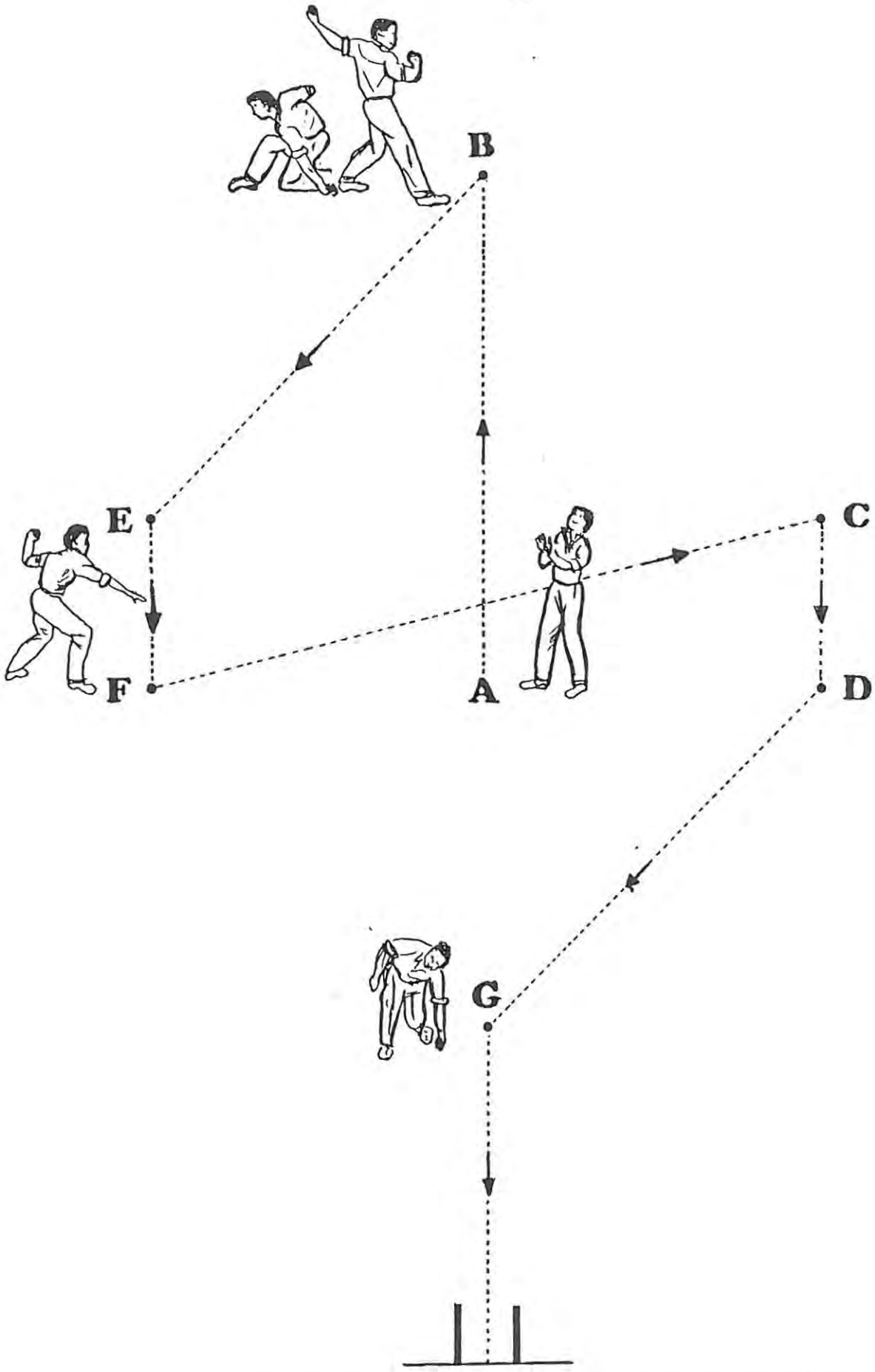


Figure 9: Diagram illustrating the path to be followed by a fielder who throws left-handed.

General Ability Test

The test of general cricket playing ability combines the important aspects of batting, bowling and fielding into a dynamic test where the players have to compete against the clock. The batting section requires co-ordination of hand, eyes, feet and mind which is essential for success in batting (Miller and Whitington 1953, Sheppard 1975). The fielding section requires the player to run at speed, in a zig-zag pattern around beacons to pick up and throw three balls at a target. A penalty is incurred for each inaccurate throw as throwing accuracy forms an important part of fielding (Bland 1969, Pollock and Pollock 1968). The bowling section requires co-ordination of trunk, arms and legs which is important for success in bowling (M.C.C. Cricket Coaching Book 1976, Pollock and Pollock 1968, Sheppard 1975, Willis 1978). The bowler is also required to bowl accurately at a target and is penalised for each unsuccessful delivery as accuracy of length and direction is a prerequisite for success in bowling (Arlott and Trueman 1977, Bland 1969, M.C.C. Cricket Coaching Book 1976, Miller and Whitington 1953, Pollock and Pollock 1968, Walker 1978).

For the test of general cricket playing ability, four markers and a target area were set out as shown in Fig 1C (p. 57). A scorer was required to use a stopwatch to time how long the player took to complete the prescribed exercise. The scorer also had to record the successful deliveries and throws at the target area and to record them on the score-sheet. For this activity the players required a cricket bat and seven 156 grams (senior players) or 135 grams (junior players) leather balls.

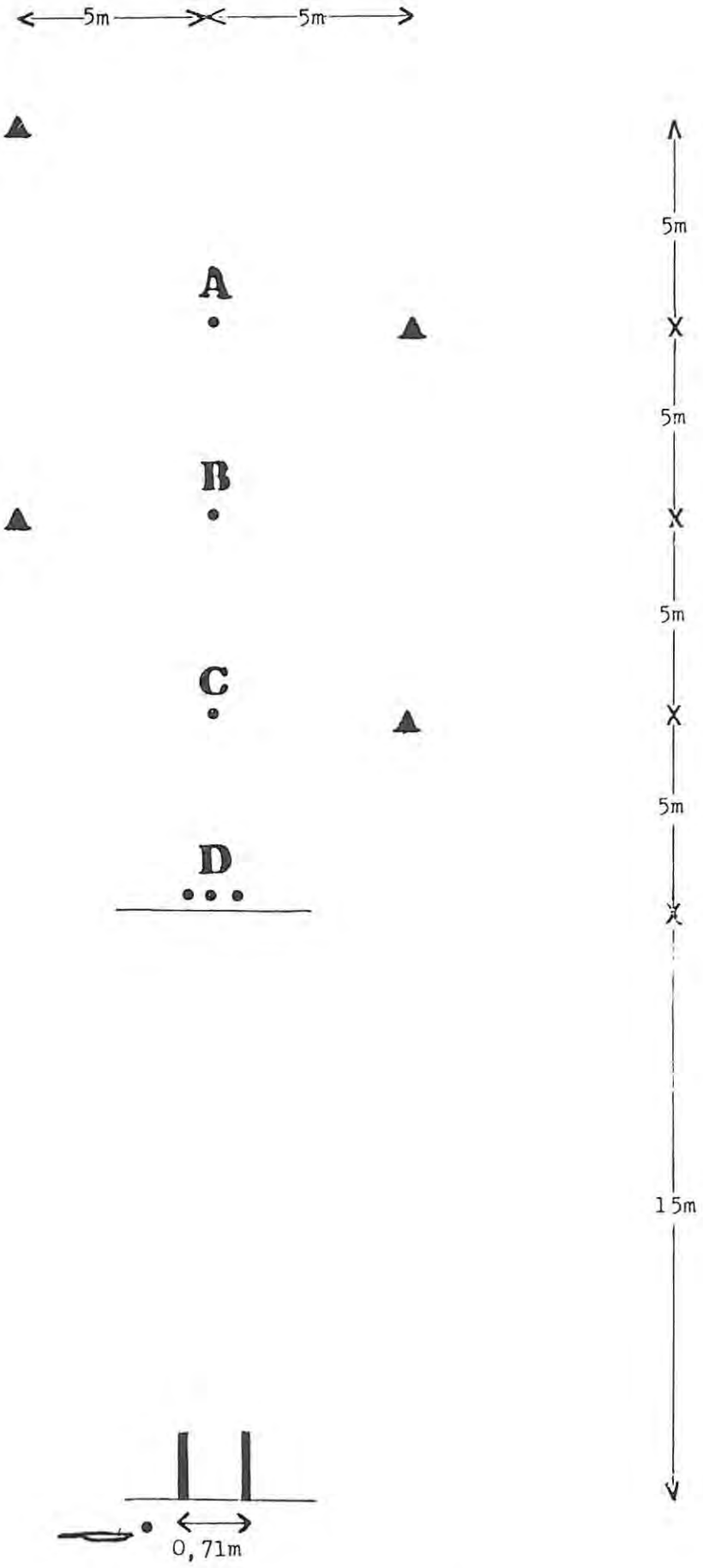


Figure 10: Plan for the setting up of the apparatus for the general ability test.

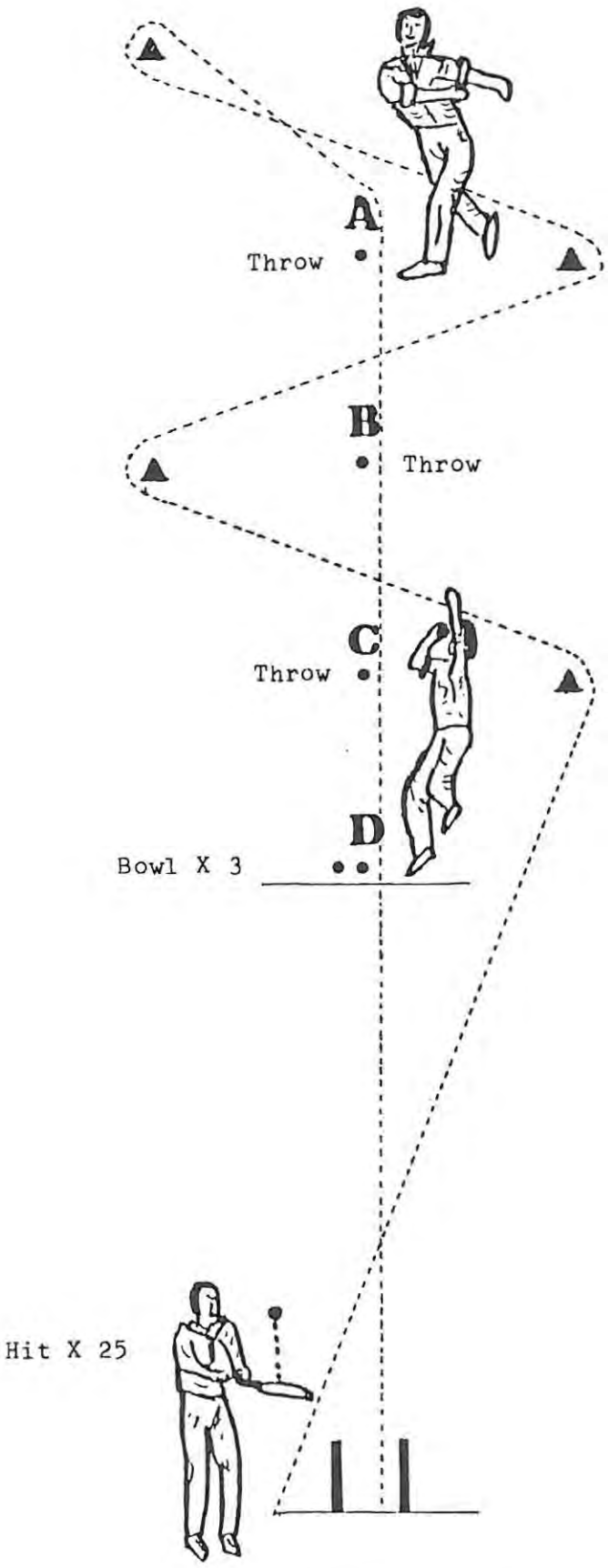


Figure 11: Diagram illustrating the general ability test.

The player started behind the start line. On the command to begin the timer started the watch and the player had to bounce the ball up and down twenty-five times on the bat. The ball had to be hit to a height of not less than thirty centimetres. If the ball was not hit to the correct height it was not counted. If the ball fell to the ground the player had to pick it up and continue. After hitting the ball up and down twenty-five times the player had to drop the bat and ball and run weaving around the markers as shown in Fig. 11(p.58). When he got to the ball at A he picked it up and threw it at the target area. He did the same with the balls placed at B and C. He then ran to D where he picked up the ball and bowled it, without a run-up, at the target area. He did the same with the remaining balls placed at D. It was stressed that the player only pick up one ball at a time. Once he had delivered the last ball he sprinted across the finish line. His time, to the nearest second, was recorded on the score-sheet. For every ball that did not pass through the target area three seconds were added to the time taken to complete the circuit. The number of errors was recorded on the score-sheet and used to determine the total time taken. The better the player the shorter should be the total time taken. The player's actual score was determined by referring to Table II (p.61).

The actual scores for the fielding and general ability tests were determined using the following formulae:

$$\text{Score} = \left(1 - \frac{TT - 20}{80}\right) \times 100$$

where: TT = Total Time (time (s) + errors (s))

20 = Best Score (s)

80 = Range (Worst Score - 20)

Worst score = 76 seconds + 24 seconds error (100 seconds) for fielding, and

82 seconds + 18 seconds error (100 seconds) for general ability.

The best and worst scores used in the formula were theoretical scores which the author believed were the fastest and slowest times that any subjects would take to complete the circuits. The slowest time took into consideration that the subject would make the maximum mistakes possible.

Subjects

The subjects consisted of 52 players from Dale College, 13 players from Stutterheim High School and 24 players from Selborne College. These players were all members of their school's first, second, third or under fifteen teams. In addition 110 primary school players from Dale College Junior School (64) Stirling Primary (22) and Selborne College Primary School (24) were also used in the study. These players were all members of their schools under eleven, twelve and thirteen teams. All the players used in this study received a minimum of three hours coaching per week and played regular matches. Both the senior and junior players were the best in their schools or age-groups and were pupils from schools with long histories of producing top schoolboy, provincial and international cricket players. It was the author's contention that there would be a wide range of ability levels in each aspect to be tested as there would be batsmen tested who never bowled in matches and bowlers who were selected purely on their bowling ability.

Table II: Determining the player's fielding and general ability scores from the total time taken.

Score	Total Time (s)	Score	Total Time (s)	Score	Total Time (s)
100	20	66	47	32,5	74
98	21	65	48	31	75
97,5	22	63	49	30	76
96	23	62,5	50	28	77
95	24	61	51	27,5	78
93	25	60	52	26	79
92,5	26	58	53	25	80
91	27	57,5	54	23	81
90	28	56	55	22,5	82
88	29	55	56	21	83
87,5	30	53	57	20	84
86	31	52,5	58	18	85
85	32	51	59	17,5	86
83	33	50	60	16	87
82,5	34	48	61	15	88
81	35	47,5	62	13	89
80	36	46	63	12,5	90
78	37	45	64	11	91
77,5	38	43	65	10	92
76	39	42,5	66	8	93
75	40	41	67	7,5	94
73	41	40	68	6	95
72,5	42	38	69	5	96
71	43	37,5	70	3	97
70	44	36	71	2,5	98
68	45	35	72	1	99
67,5	46	33	73	0	100

The author conducted the objective skills tests on his own, while he was assisted by the various coaches of the teams to do the subjective evaluations. All the coaches involved have had considerable coaching experience. Of the fourteen coaches involved four had the First Coaching Certificate of the South African Cricket Union. Four of the coaches have represented their provinces on the cricket field. The author, besides being a provincial player and experienced coach, has the First Certificate and the Advanced Coaching Certificate of the South African Cricket Union.

To determine whether the tests would be valid measures of cricket playing ability a total of one hundred and fifty-five subjects were assessed. Each player was evaluated subjectively by his coach and the author while practicing in the nets and objectively, using the four tests, by the author only. Where possible, these tests were conducted on the same day.

In the subjective evaluations the author and coaches of the various teams assessed the players using the guidelines set out below. Each player was assessed out of a possible score of 100. At the commencement of the subjective assessments the author and the coach independently assessed the players considered to be the best in each aspect of batting, bowling and fielding. Having done this, the scores were compared. If a discrepancy of more than five percent occurred, the two consulted and adjusted the scores so that a set standard could be established as a basis to work from.

After having assessed each of the other players independently, the author and coach consulted each other and if a difference of more than five percent occurred, then the player was discussed and a score was agreed upon. Where a difference of five or less occurred, the average of the two scores were taken as the score for the subjective evaluation. This method is based on the system used to evaluate competitive gymnastics (Bowers et al 1981) and recommended by Franks and Deutsche (1973).

The coach was instructed to use the given guidelines and his knowledge of the various aspects for success in cricket to determine the player's potential success in the actual match situation. Each player was assessed in the role that he performs in his team, be it a first team or an under-age team.

The following guidelines were used:

85 and above	-	exceptional standard for his age-group
80	-	provincial standard for his age-group
75	-	possible provincial player for his age-group
70	-	invited to provincial trials for his age-group
65	-	good team player, but unable to make trials
60	-	above average team member
55	-	average team member
50	-	below average team member
45	-	able to perform reasonably well at nets, but not good enough in a match
40	-	performs poorly
35	-	weak
30 and below	-	very weak

When assessing the players, the coaches took the following into account:

Batting:
- how solid is the player's defence?
- is he able to score freely off bad deliveries?
- would he be able to score runs consistently?
- how often is he dismissed in the nets?

- how often does he play false strokes in the net?
- is he able to concentrate for long periods of time?

Bowling:
- has the bowler good control of the ball?
- has he good control of length and direction?
- how much spin does he impart to the ball?
- how fast is he able to bowl?
- does he vary his deliveries?
- how many good/bad balls does he bowl?
- is he able to concentrate for long periods of time?

Fielding:
- has he a safe pair of hands - in the air and on the ground?
- has he a fast and accurate throw?
- is he able to anticipate and move fast?
- does he remain calm if there is a chance of a run-out?
- is he able to concentrate for long periods of time?

The subjective score of general ability was determined by adding the batting, bowling and fielding scores obtained and finding the average.

To determine whether the objective tests would be reliable when repeatedly administered by various testers, an experienced and four relatively inexperienced testers assessed forty-four players, made up of four teams. The experienced tester, the author, first evaluated two teams made up of 23 players. After this they were evaluated by their coaches, the inexperienced testers. The other two teams ($n = 21$) were first evaluated by the inexperienced tester, their coach, and then by the experienced tester, the author.

To determine whether the tests would be reliable when repeatedly administered by one tester, and to determine the degree of learning involved in the objective tests, a group of 23 players were objectively assessed on five consecutive days.

Statistical treatment of the data

The following mathematical tests were employed to test the hypotheses:

1. Single variable statistics (mean, standard deviation and coefficients of variance, skewness, kurtosis and determination), frequency histograms and one independent variable regressions were computed to give a greater insight into the objective and subjective scores. A t-test for related samples was used to test for a significant difference between the objective and subjective scores obtained in the four tests (Ferguson 1981). A statistically significant t ($p < 0,05$) would indicate that the subjective and objective scores differ. A statistical significant Pearson Product-Moment correlation coefficient (r) ($p < 0,05$) would lend support to the validity of the objective tests of batting, bowling, fielding and general ability.

2. A two-way analysis of variance was employed to examine the reliability of the tests when administered by various testers (Ferguson 1981). In this analysis the column effect (Factor 1) comprised two levels: the first and second test sessions. The row effect (Factor 2) also comprised of two levels: the inexperienced and experienced testers.

3. A one-way analysis of variance with repeated measures was used to examine the reliability of the tests when repeatedly administered by one tester (Ferguson 1981). A statistical significant difference would indicate that the tests are not reliable when repeatedly administered

by one tester. Any differences, so identified, were treated to POST HOC analysis by the Tukey method (Weber and Lamb 1970) in order to identify between which test administrations these differences lie.

For all tests, critical values at the five percent level of confidence were required for significance.

CHAPTER 4

RESULTS AND DISCUSSIONS

The one hundred and fifty-five subjects assessed subjectively and objectively by the author and various coaches of the teams had a mean age of 13,0 years (±4,0). Of these, seventy-four were High School pupils and eighty-one were Primary School pupils. The forty-four subjects used to test the objectivity of the test had a mean age of 13,0 years (±2,1), while the twenty-three subjects used to test for reliability had a mean age of 11,9 years (±0,7).

The players assessed in this study were made up of eighty-nine players who played for their schools' first, second, third or under fifteen teams. The other one hundred and ten subjects observed were all Primary School players. They were members of their schools' under eleven, twelve or thirteen teams.

Validity

The results of the subjective and objective evaluations on the one hundred and fifty-five subjects assessed are shown in Table III(p. 68). Although these scores appear to be very similar, the batting, fielding and general ability scores all differed significantly ($p < 0,05$). When the subjective and objective scores were correlated a significant correlation ($p < 0,05$) was found for all four tests (Cohen and Holliday 1979). These correlations were used to obtain the coefficients of determination (Table III, p.68). When a scattergram of the relationship between the subjective and objective scores were drawn up (Fig. 13 to Fig. 16 ,p. 71 to p. 74), batting,

Table III: Comparison of cricket skills scores obtained through subjective and objective evaluations (n = 155).

	Batting		Bowling		Fielding		General Ability	
	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.
$\bar{X}$	57,6	59	56,1	57	61,7	70,8	58,3	53,5
	*				*		*	
S.D.	9,7	12,9	10,3	11,2	8,9	7,7	8,0	11,2
C.V.	16,7	21,6	18,3	19,8	14,5	10,8	13,7	20,9
Coefficient of Skewness	0,09	-0,11	0,17	0,02	-0,11	-0,56	0,14	-0,38
Coefficient of Kurtosis	-0,47	-0,71	-0,19	-0,23	-0,39	0,50	-0,27	0,24
Coefficient of Determination	0,53		0,66		0,22		0,18	
Correlation Coefficient (r)	0,73*		0,81*		0,47*		0,43*	

* Significant difference at the five percent level ($p < 0,05$).

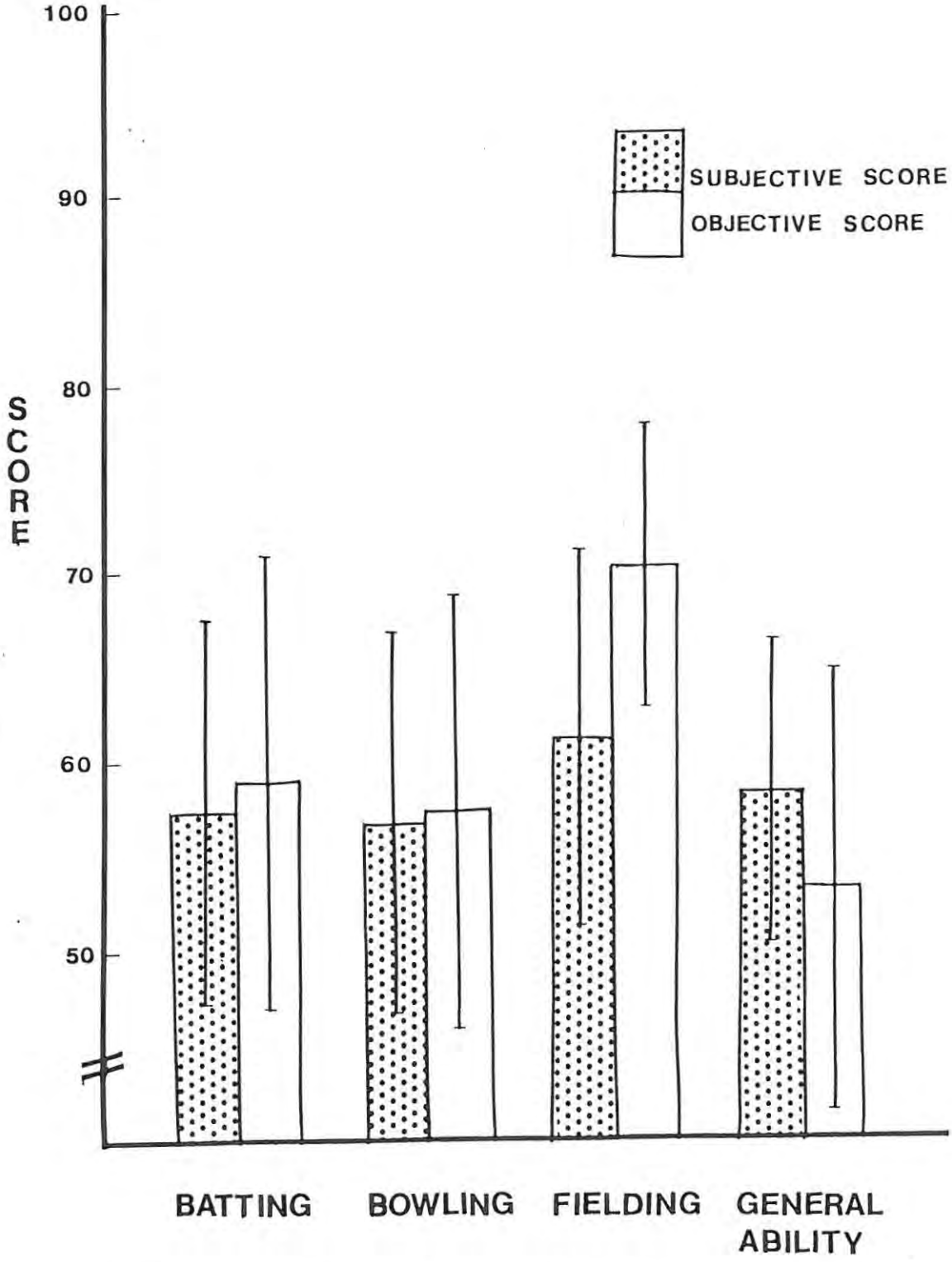


Figure 12: Comparison of cricket skills scores obtained through subjective and objective evaluations (n = 155).

bowling and general ability all showed curvilinear power regressions, while fielding showed a curvilinear exponential regression.

The frequency distribution of the scores obtained from the subjective evaluations and objective tests are shown in Fig. 17 and 21 (Batting), Fig.18 and 22 (Bowling), Fig. 19 and 23 (Fielding) and Fig.20 and 24 (General Ability).

In the batting test the subjective scores are concentrated between 45,1 and 70, with 80 percent falling between these two scores (Fig. 21, p. 80). The objective scores for the batting test falling between 45,1 and 70 only makes up 63%. However, the scores for the objective test are spread out fairly evenly between 45,1 and 80, with 84 percent falling between these two scores. This would tend to indicate that the objective batting test is able to make a greater differentiation between players than the coach does using a subjective evaluation. This point is further emphasised as the objective tests have a range of 60 as opposed to the range fo 45 obtained in the subjective tests. Determining the performance levels of players taking part in team games is often more difficult to determine than in individual sports (Johnson and Nelson 1979). This could possibly result in the coach being wary of rating players at the extremes of the scale. In addition, the guidelines that the author set out for the subjective evaluations rated the players with "exceptional standard for his age-group" as eighty-five or above and those who were "very weak" as thirty or below. This

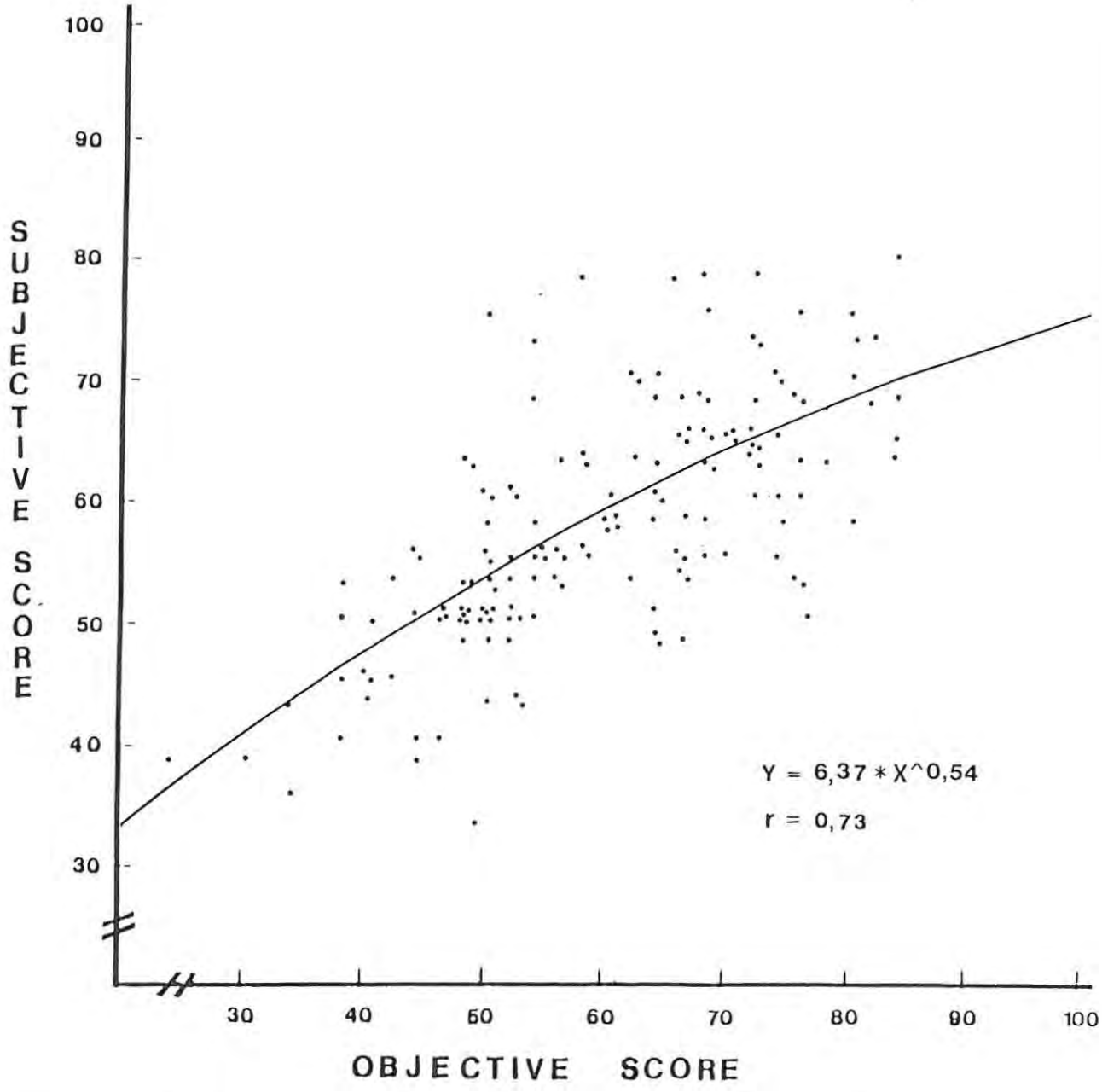


Figure 13: Scattergram showing the relationship between the cricket batting skills scores obtained through subjective and objective evaluations (n = 155).

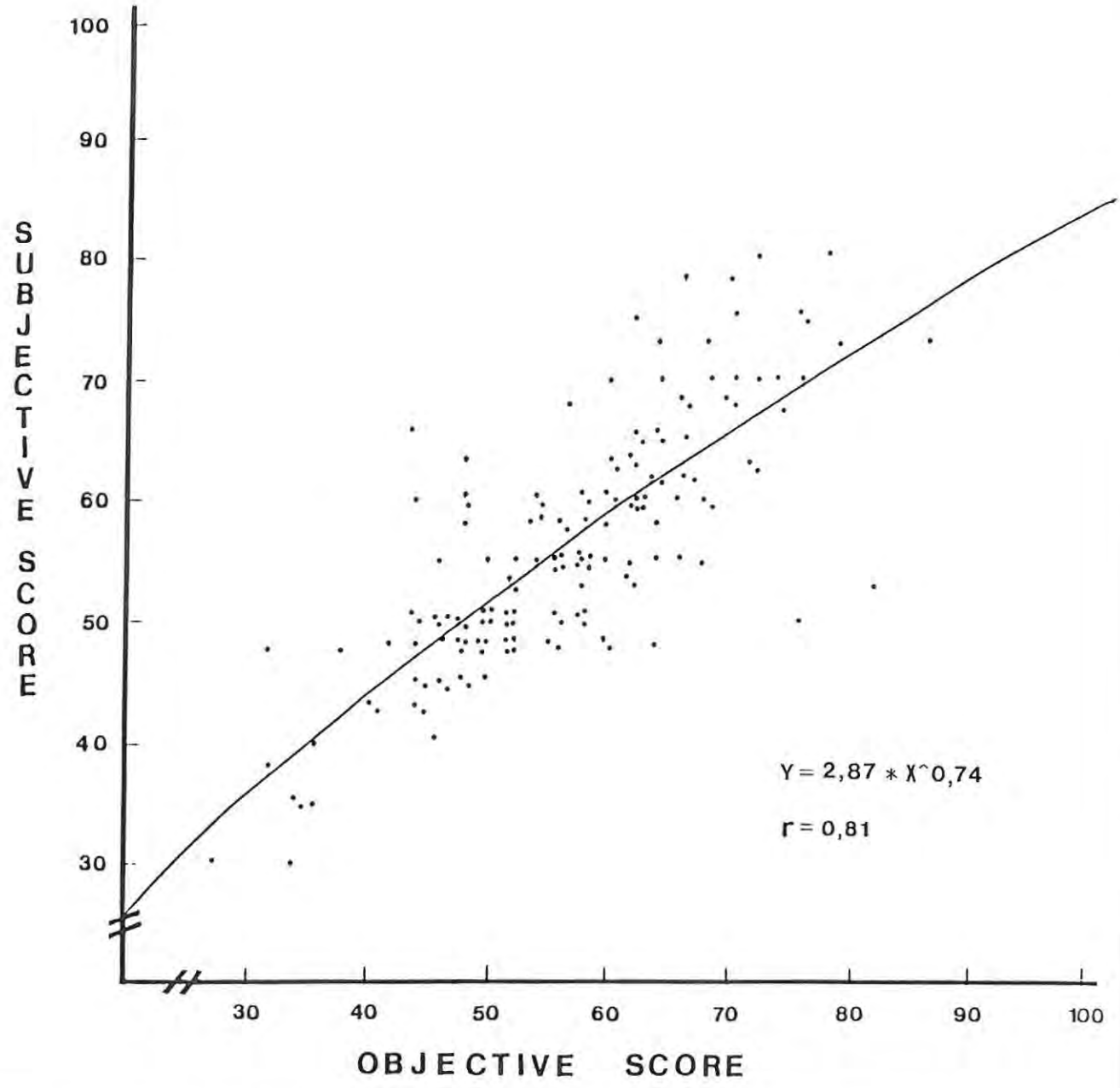


Figure 14: Scattergram showing the relationship between the cricket bowling skills scores obtained through subjective and objective evaluations (n = 155).

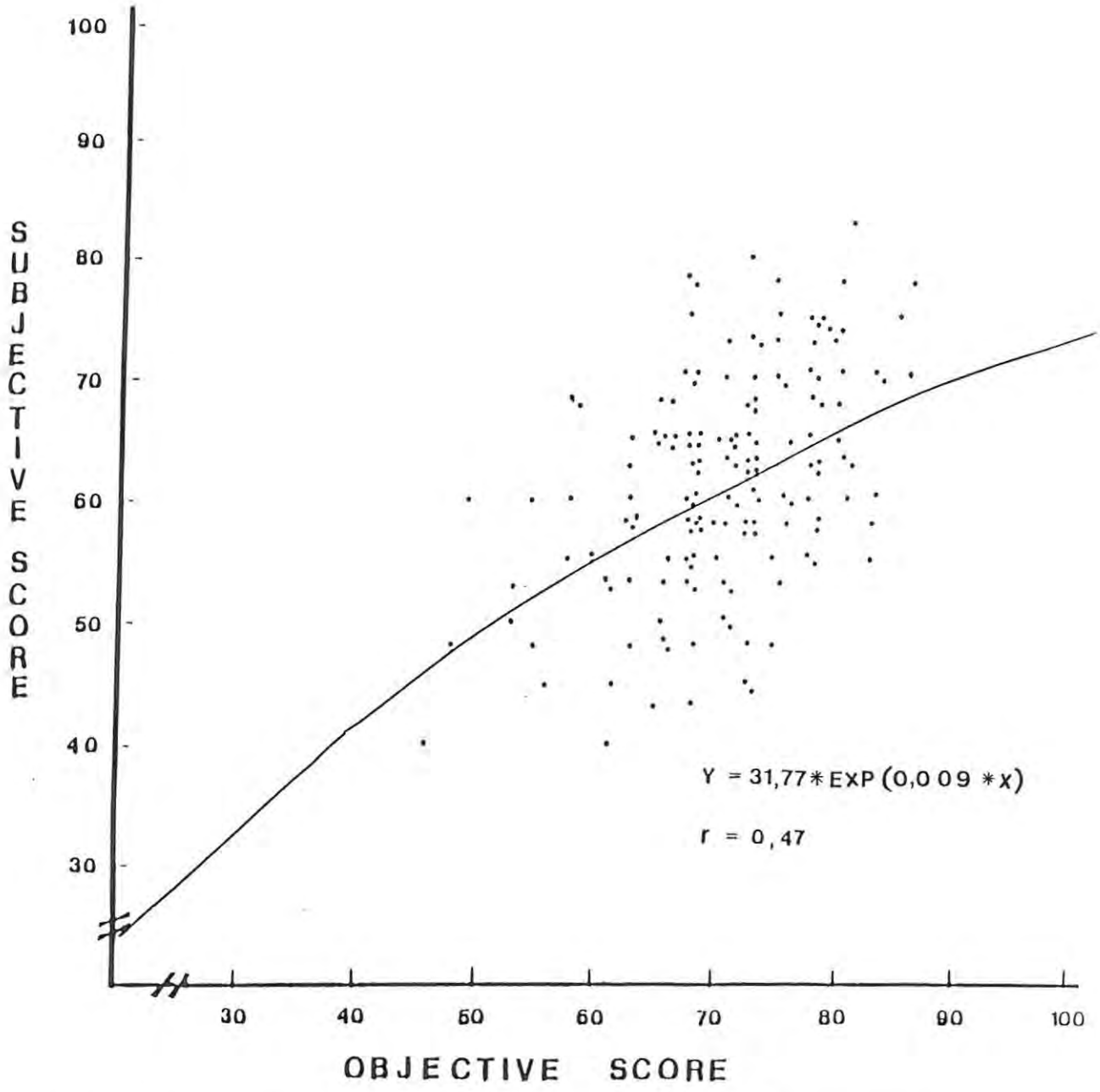


Figure 15: Scattergram showing the relationship between the cricket fielding skills scores obtained through subjective and objective evaluations (n = 155).

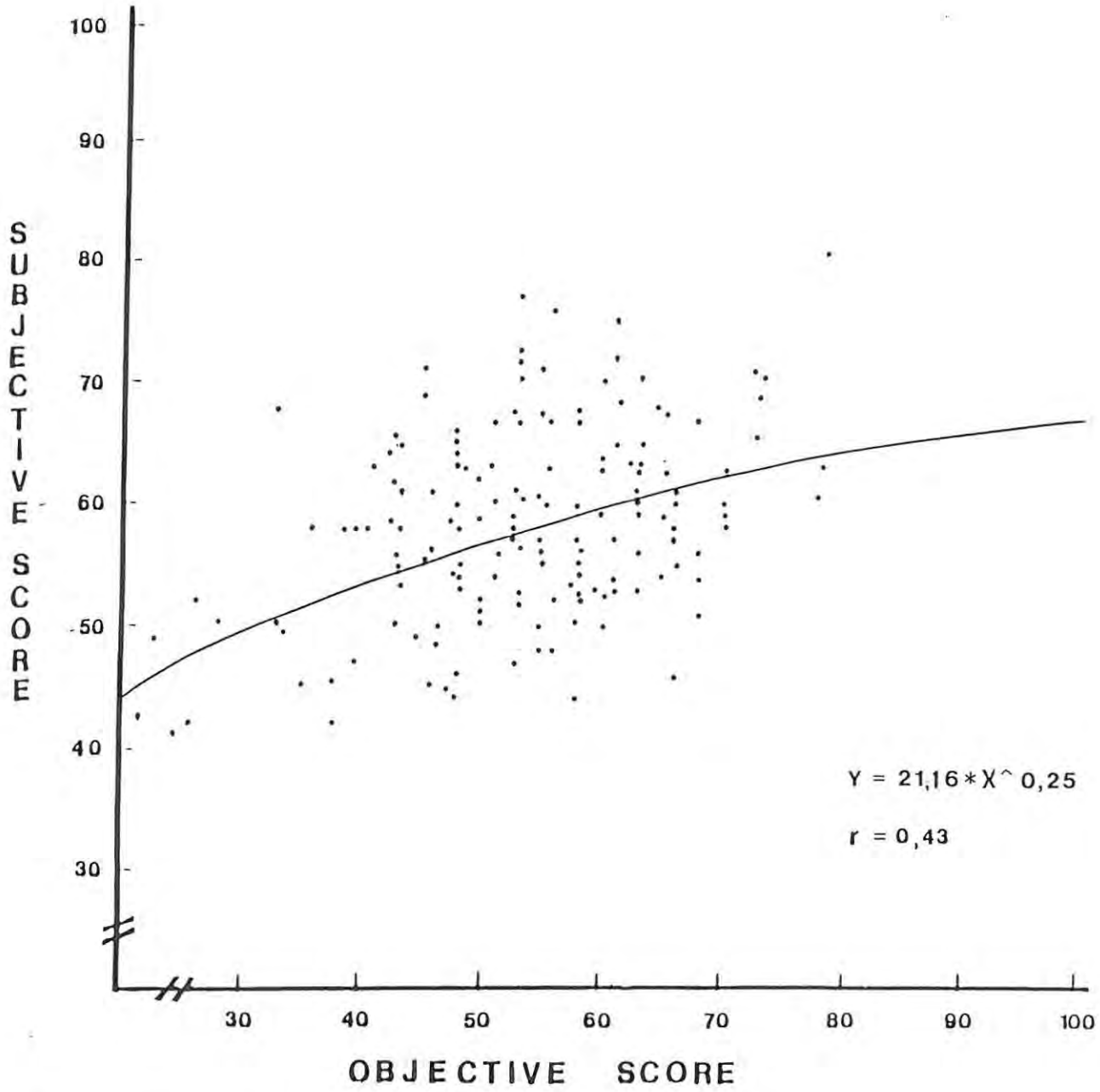


Figure 16: Scattergram showing the relationship between the cricket general ability skills scores obtained through subjective and objective evaluations (n = 155).

may also have influenced the subjective evaluations and resulted in the scores being clustered closer together than in the objective tests. Five scores of between 75,1 and 80 were recorded as the highest scores for the subjective evaluation, while 16 scores were recorded for the objective test between those two scores and a further five scores between 80,1 and 85. At the lower end of the graph a similar pattern occurred with the objective test recording more scores at a lower level.

In the bowling test 70 percent of the subjective test scores are concentrated between 45,1 and 65 (Fig. 22 ,p. 81). Of these 27 percent fall in the area between 45,1 and 50. In the objective bowling test only 63 percent fall within the 45,1 to 65 area. As in the objective batting test, the objective bowling test has a large range, 58, as opposed to the 50 for the subjective evaluation. In the objective test more scores are also found at the extremes of the scoring scale which indicates that the bowling test is able to make a greater differentiation between the bowlers than the coach using subjective evaluation.

In the fielding test, 90 percent of the players evaluated subjectively had scores between 45,1 and 75 (Fig. 23 ,p. 82). In the objective test 72 percent fell within the same area. However, in the objective test the scores tended to be concentrated between 65,1 and 80, with 72 percent falling in this region. Although the objective test tended to have a concentration of scores between 65,1 and 80 only a small diff-

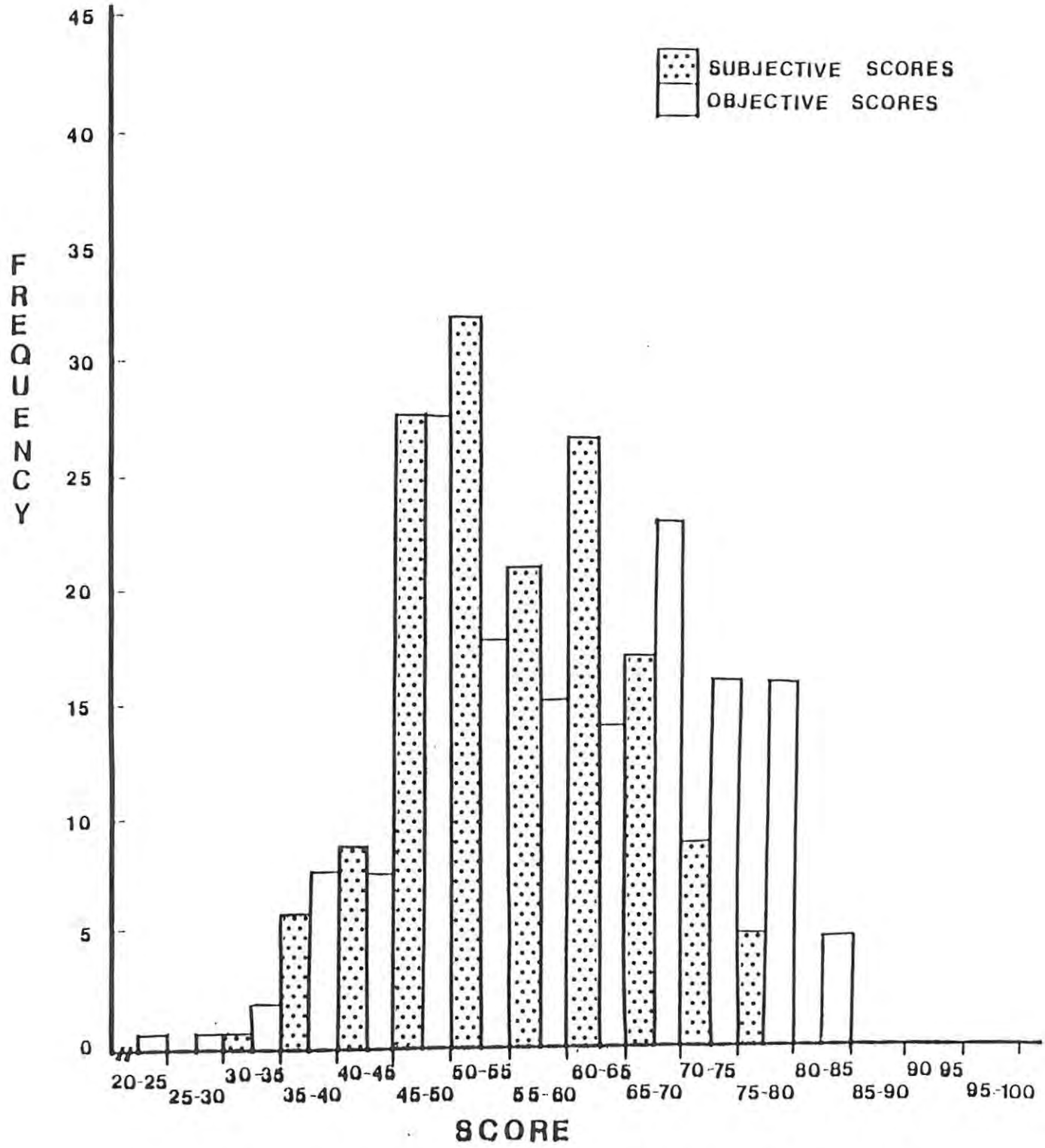


Figure 17: Distribution of cricket batting skills scores obtained through subjective and objective evaluations (n = 155).

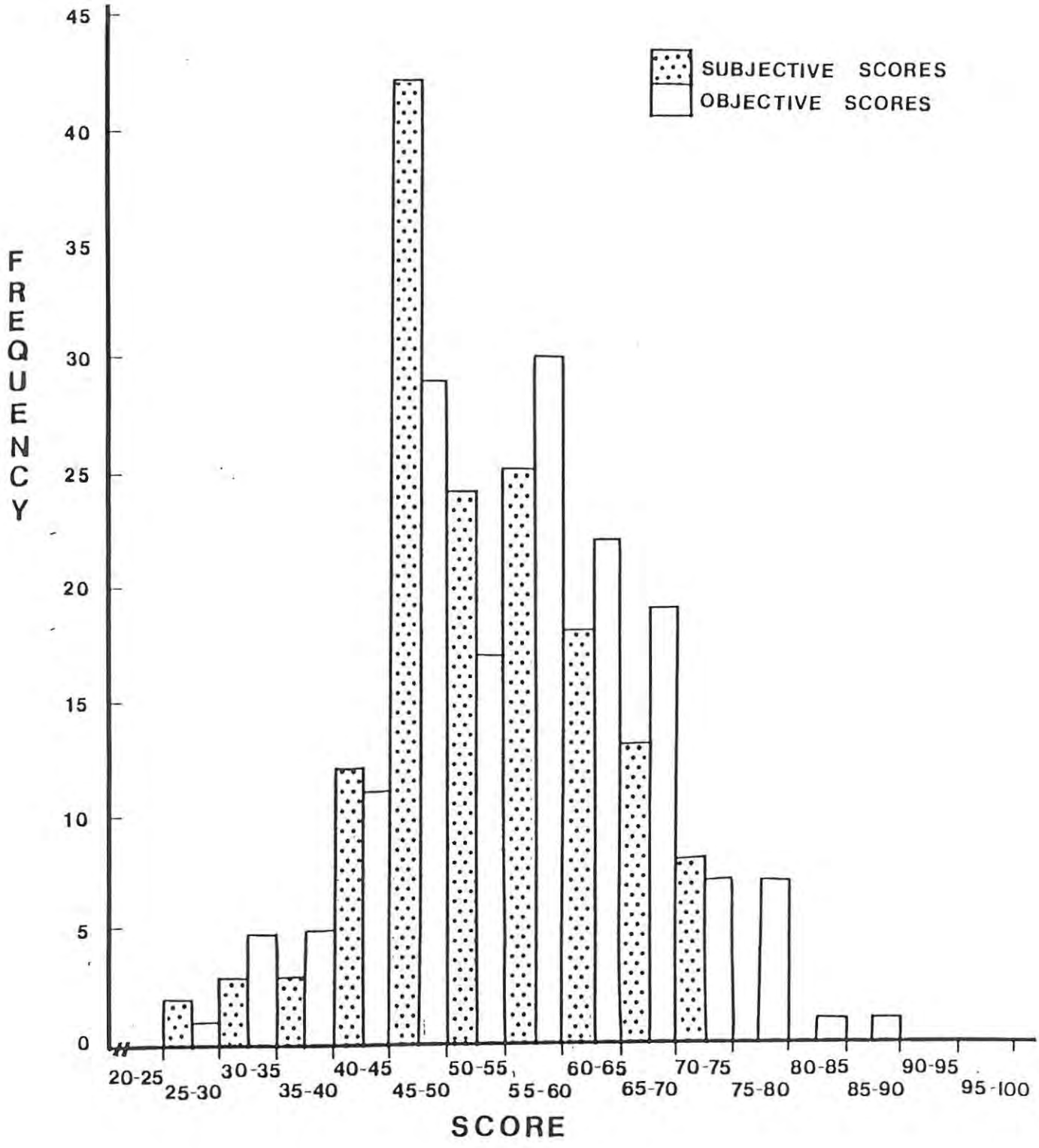


Figure 18: Distribution of cricket bowling skills scores obtained through subjective and objective evaluations (n = 155).

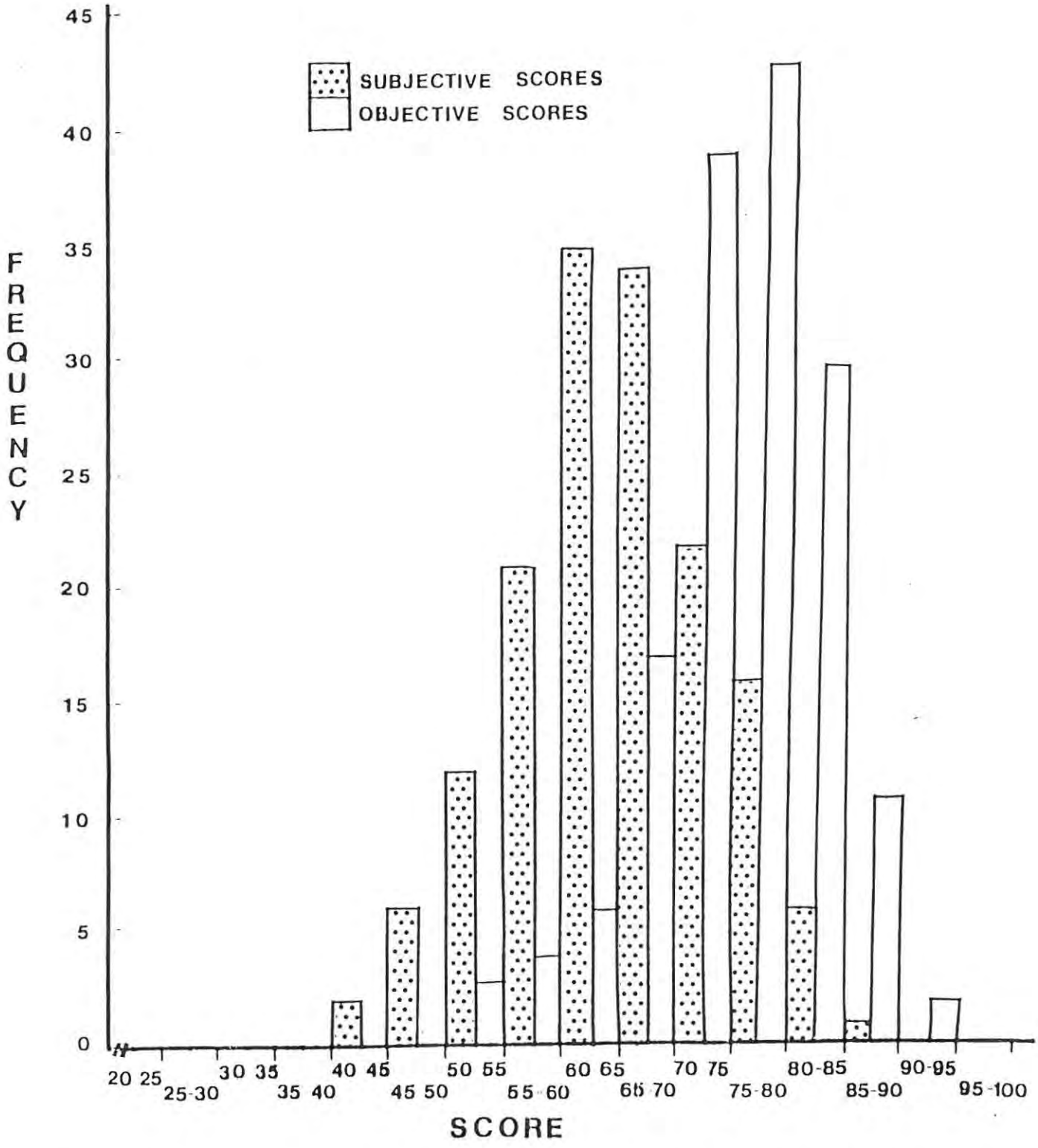


Figure 19: Distribution of cricket fielding skills scores obtained through subjective and objective evaluations (n = 155).

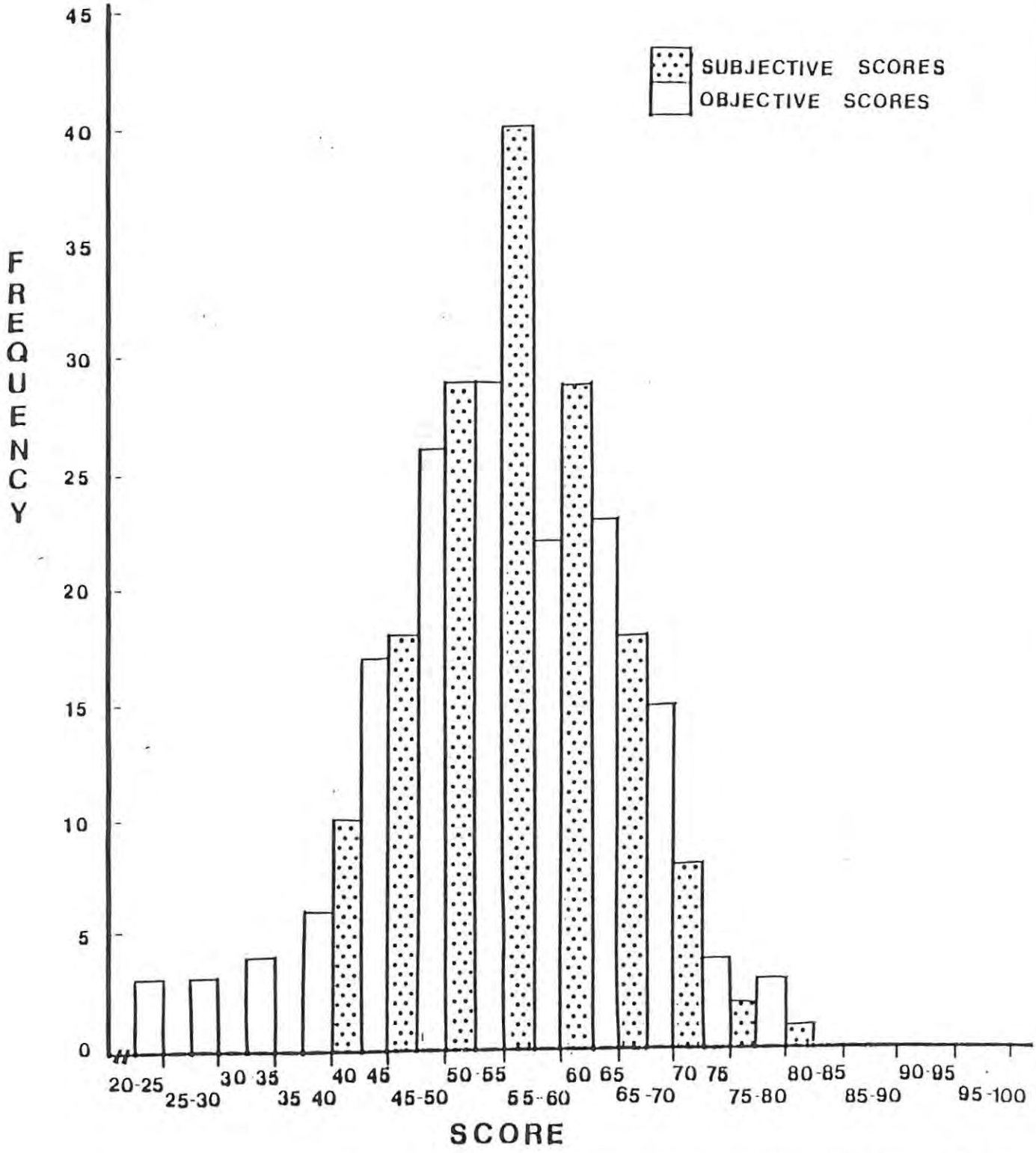


Figure 20: Distribution of cricket general ability skills scores obtained through subjective and objective evaluations (n = 155).

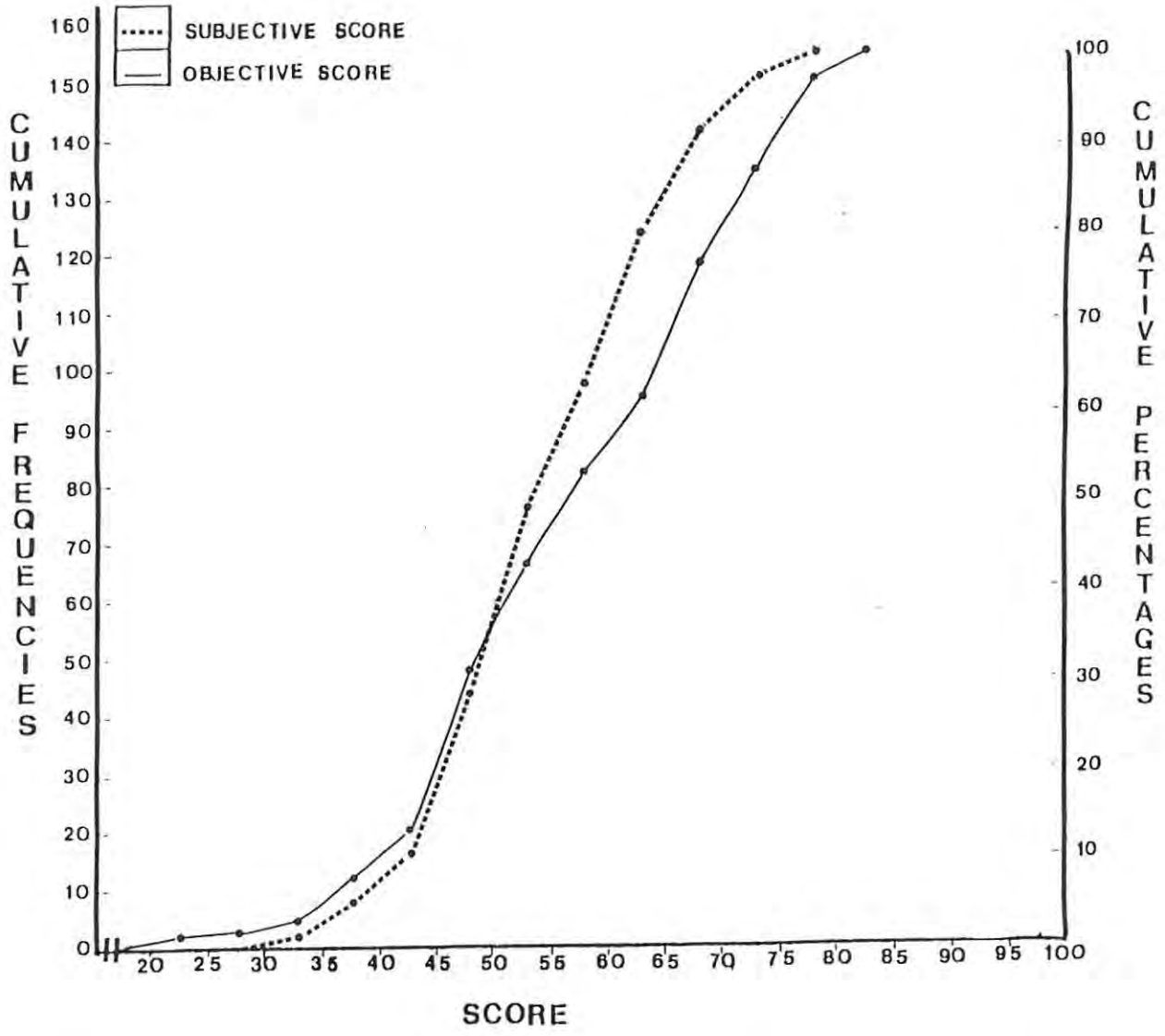


Figure 21: Cumulative frequencies and percentages obtained for cricket batting skills scores obtained through subjective and objective evaluations (n = 155).

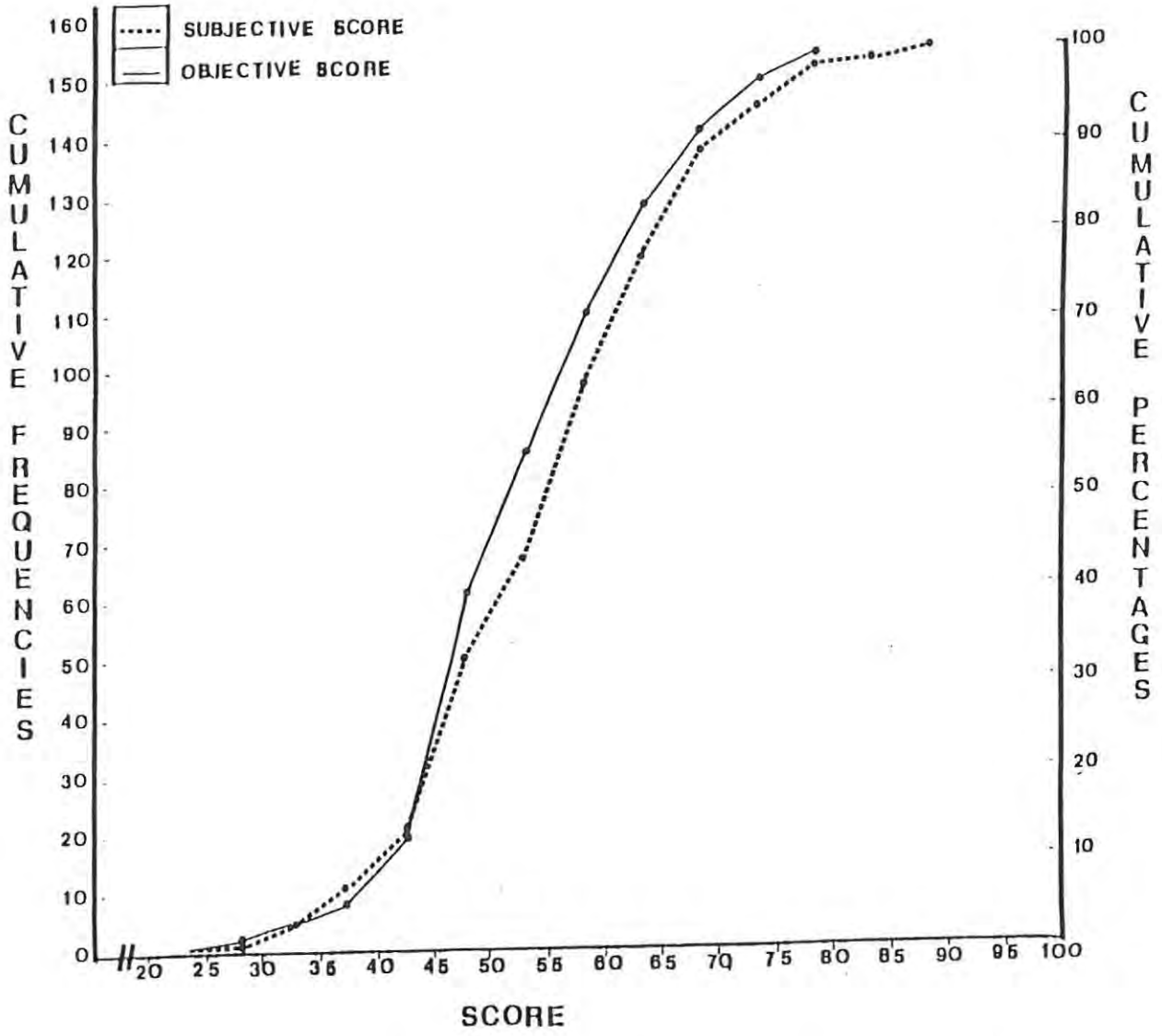


Figure 22: Cumulative frequencies and percentages obtained for cricket bowling skills scores obtained through subjective and objective evaluations (n = 155).

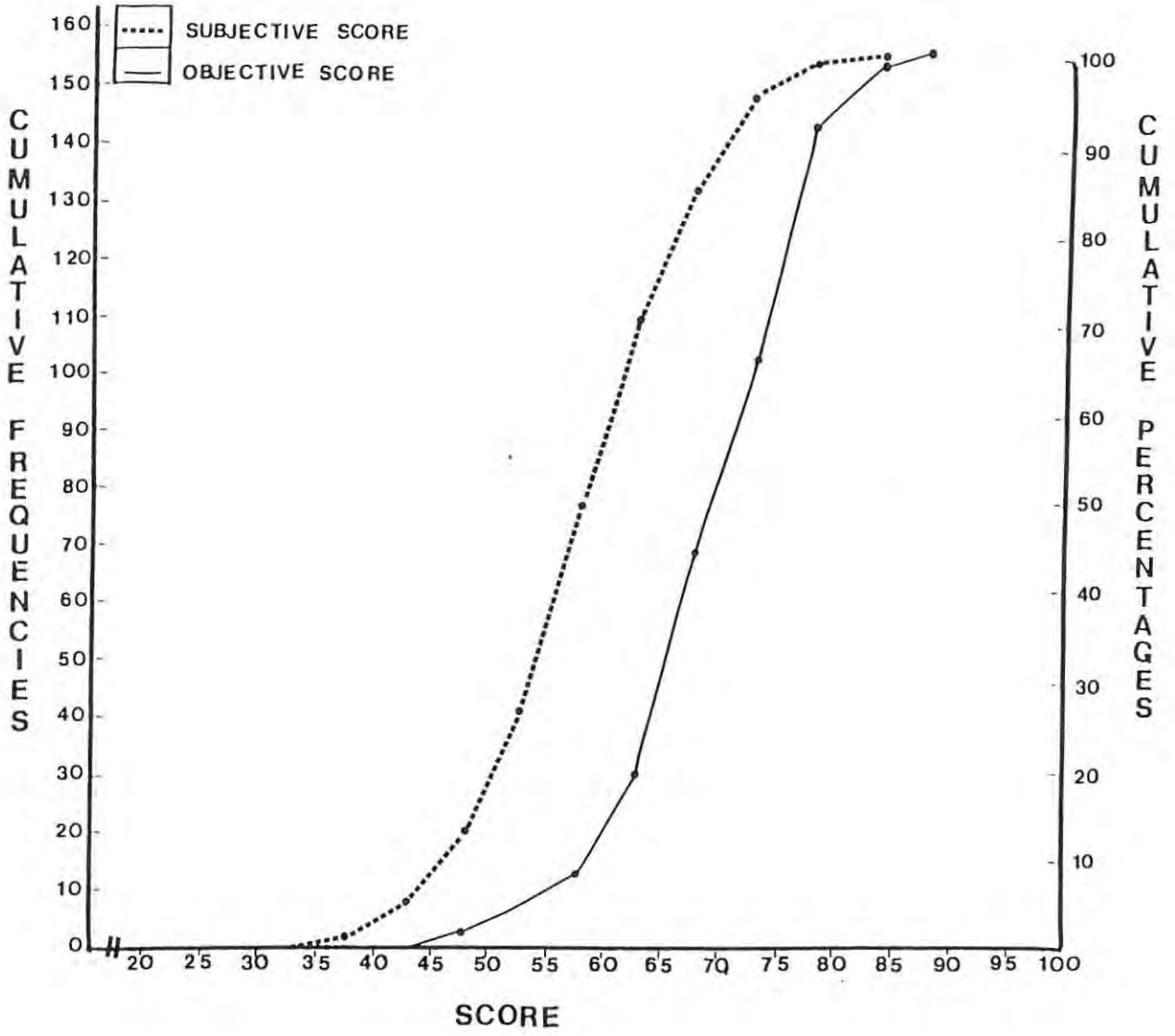


Figure 23: Cumulative frequencies and percentages obtained for cricket fielding skills scores obtained through subjective and objective evaluations (n = 155).

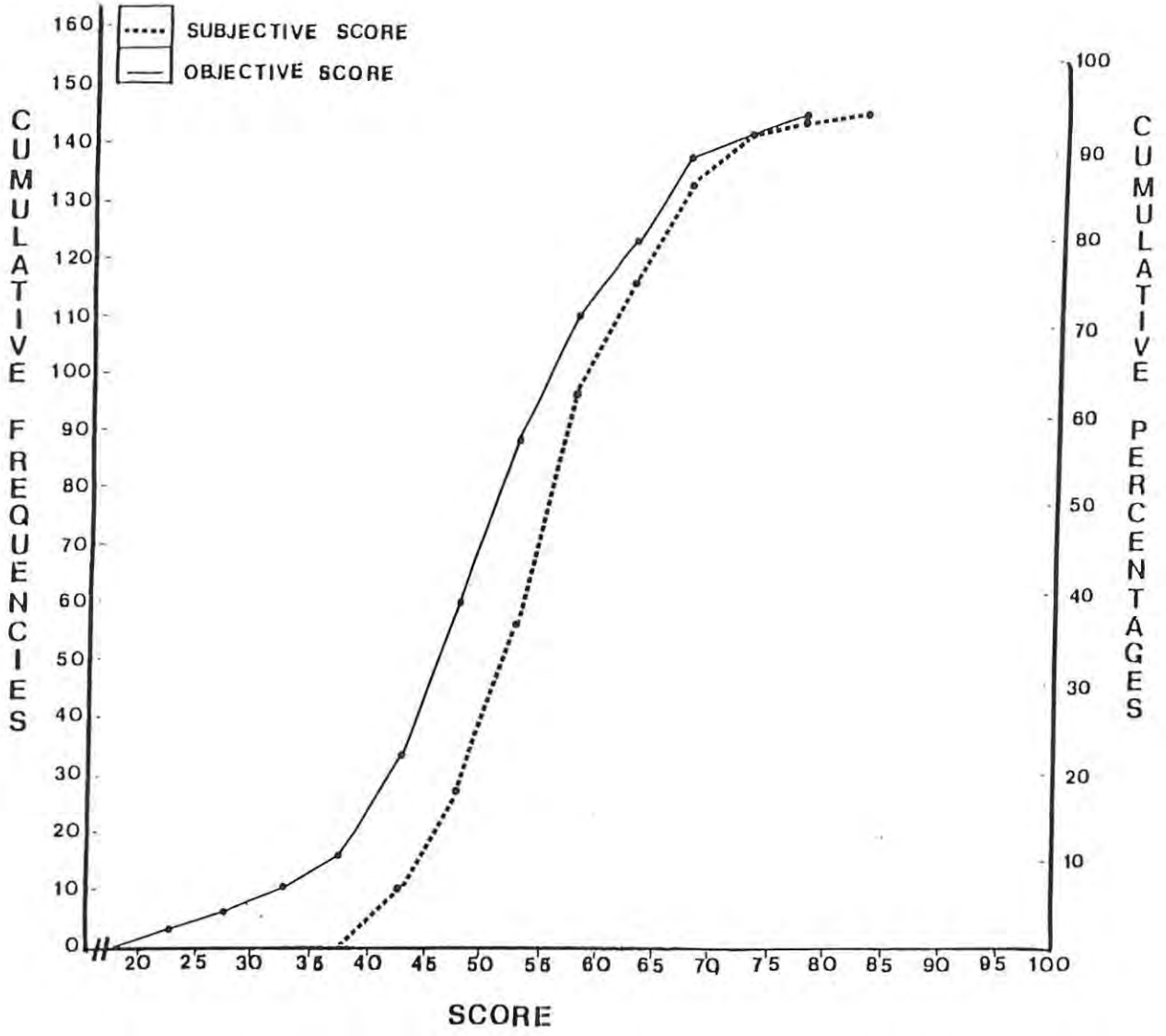


Figure 24: Cumulative frequencies and percentages obtained for cricket general ability skills scores obtained through subjective and objective evaluations (n = 155).

erence in range occurred between the objective (40) and subjective (43) tests which would tend to indicate that the spread of scores for the two tests is fairly similar.

In the test of general ability a similar pattern occurs as in the batting and bowling tests (Fig. 24,p. 83). In the subjective evaluation 86 percent of the scores fall between 45,1 and 70, while only 74 percent of the objective scores fall in that area. Similarly the objective test has a wider distribution with more scores at the upper and lower end of the scale. The objective tests have a range of 56 as opposed to the range of 40 found in the subjective test. These factors would tend to indicate that the objective test of general ability would assist the coach in the difficult task of differentiating between players to a greater degree.

The objective test of general ability showed a mesokurtic value (0,24), while the objective fielding test showed a leptokurtic value (0,50) (Clarke and Clarke 1970). The other tests all show platykurtic values (Table III ,p. 68). From this it is evident that all the subjective and objective evaluations, with the exception of the objective general ability test and the objective fielding test, all have a height that falls below the normal distribution. The objective batting and bolwing tests both show greater platykurtic trends than the subjective tests.

The height of the curve would tend to fall below the normal curve for both batting and fielding tests, as well as the

subjective fielding and general ability tests. The objective scores for fielding fall above the normal distribution, while the height to the objective general ability test was very similar to that of the normal distribution.

The coefficients of skewness for the subjective tests of batting, bowling and general ability as well as the objective bowling test, are all positive values thus indicating that the concentration of the scores fall below the centre (Clarke and Clarke 1970). The objective scores for batting, fielding and general ability, as well as the subjective fielding test, show negative skewness thus indicating that the scores are concentrated above the centre. In the batting and bowling tests the coefficients of skewness for the subjective tests show a greater deviation from the normal distribution than the objective tests do. The converse is true for the fielding and general ability tests. However, none of these were found to differ significantly from the normal distribution ($p < 0,05$).

Although a significant difference occurred between the mean values for the subjective and objective tests of batting, fielding and general ability, a significant correlation coefficient ($p < 0,05$) was obtained for these three tests plus the bowling test (Cohen and Holliday 1979). According to Baumgartner and Jackson (1975) and Cohen and Holliday (1979) the batting and bowling tests, with their correlation coefficients of 0,73 and 0,81, would be considered to be high to very high correlations. Cohen and Holliday (1979) would

consider the fielding (r = 0,47) and general ability (r = 0,43) tests to be modest or substantian relationships.

Campbell and Tucker (1967) believe that the degree of validity demanded before a test is acceptable, will depend to a large extent upon what the test sets out to measure. They believe that the more subjective the character to be measured, the lower the accepted coefficient of validity would be. In fielding the ability to anticipate well is a pre-requisite for success (Pollock and Pollock 1968). This would make fielding, and as a result general cricket playing ability, more subjective and thus more difficult to assess than batting and bowling.

Furthermore, Clarke and Clarke (1970) state that a number of factors may affect the correlation coefficient. A narrow range, as was found in all four the subjective evaluations and the objective fielding tests, tends to reduce r. Clarke and Clarke (1970) state that slight changes in the distribution result in greater variations in the distribution positions. These authors also believe that descriptions of correlation coefficients being high or low are meaningless unless reference is made to the correlation needed for the number of subjects upon which the correlations are based. From this it is evident that the greater the sample size, the lower the desirable r. In the present study the sample size (n= 155) is relatively large and thus a lower r would be acceptable indicating that these tests are valid tests of cricket playing ability.

In the fielding test a penalty of three seconds is added on to the time taken if the catch is dropped and for each throw which did not pass through the target area. This could result in a total penalty time of 24 seconds being added on to the time taken. From the literature it became evident that a safe catcher of the ball (Pollock and Pollock 1968) who possesses a fast and accurate throw (Bland 1969, Pollock and Pollock 1968) would be a good fielder. It was for this reason that the penalty time played such a large part in the fielding skills test. The fielding test does not consider catching and fielding close to the wickets or wicket-keeping. If these aspects had been tested the testing time would have been greatly increased and would possibly have discouraged coaches and teachers from using this battery of tests. As fielding close to the wickets and wicket-keeping are such specialist positions it was not deemed necessary or worthwhile to devise tests for these aspects of fielding.

In the general ability test the player's scores for the subjective evaluations of batting, bowling and fielding were used to determine his subjective general ability score. This score was then compared to his objective score for the general ability skills test. This was done as it was the author's contention that it would have been difficult to assess the player's ability as a whole to give him a score for general playing ability. The objective test assesses many of the essential features necessary for success in batting, bowling and fielding. However, many factors such as fast reactions (Miller and Whitington 1953, Arlott and Trueman 1977, Pollock

and Pollock 1968, M.C.C. Cricket Coaching Book 1976), co-ordination of trunk, arms and legs (M.C.C. Cricket Coaching Book 1976, Pollock and Pollock 1968, Sheppard 1975, Willis 1978) and anticipation (Pollock and Pollock 1968), which play an important part in batting, bowling and fielding, can not be be assessed directly in sports skills tests. In addition, other non-physical factors such as co-operation and co-ordination with team members, social, intellectual and the emotional state of the individual all play a vital role in team games (Campbell and Tucker 1967).

Thus, due to the subjective nature of fielding and general cricket playing ability a lower correlation coefficient would be expected for these two aspects. The reason why the batting and bowling tests appear to be more accurate tests may be due to the fact that the methods used in the sports skills tests to assess these aspects relate very closely to the technique and proven methods of practice used by top coaches and players (Greig 1974, Sheppard 1975, Willis 1978). As a result these practice methods have been copied by many promising players who have been keen to emulate their heroes. In addition, the skills required for these two tests are very similar to those required in the actual game situation. Finally, the very nature of batting and bowling make these aspects of cricket more easily quantified than fielding and general ability.

The coefficients of determination for batting (0,53) and bowling (0,66) are relatively high. This is due to the fact

that the skills required in these objective tests are similar to the skills used by many players to practice the skills of batting and bowling (Greig 1974, Sheppard 1975, Willis 1978). The fielding and general ability tests only showed coefficients of determination of 0,22 and 0,18 respectively.

When the predictive index (PI) was calculated for each of the tests they were found to be: Batting 0,31; Bowling 0,42; Fielding 0,12 and General Ability 0,09. Thus a knowledge of the objective batting, bowling, fielding and general ability test results would enable one to be 31%, 42%, 12% and 9% respectively, better at predicting the subjective skills levels than predicting purely by chance alone.

These results would seem to indicate that the objective tests for fielding and general ability require very little of the skills actually required in the match situation. However, due to these aspects of the game being more subjective in character they are more difficult to assess objectively, thus causing lower correlation coefficients and coefficients of determination (Campbell and Tucker 1967). In batting and bowling the runs scored and wickets taken can be used to obtain an average per innings for the players. This can be of assistance to the coach when assessing players. However, no such score or average can be obtained for fielding.

Thus it is the author's contention that these tests should be accepted as valid tests of batting, bowling, fielding and

general cricket playing ability although the fielding and general ability tests have relatively low correlation coefficients and coefficients of determination. These tests, when used with his assessment of the players, would enable the coach to differentiate more greatly between the various players in each aspect of play.

Objectivity

To determine whether the four tests were objective when administered by different testers, the author (experienced tester) and the coach of the team (inexperienced tester) each conducted the battery of tests on Group A (n =23) and on Group B (n =21). Group A subjects were first tested by the experienced tester and then by the inexperienced tester. The procedure was reversed for Group B.

No significant difference ($p < 0,05$) was found between the scores for the experienced and the inexperienced testers which indicates that the tests are objective when administered by different testers under similar circumstances (Table IV and Fig. 25). When the scores obtained by the experienced and inexperienced testers were correlated the following significant coefficients ($p < 0,05$) were found: Batting $r = 0,68$; Bowling $r = 0,78$; Fielding $r = 0,41$ and General Ability $r = 0,57$. From Clarke's (1976) generally accepted objective standards the bowling test

would appear to be adequate for group measurement, but not satisfactory for individual measurement. The batting, fielding and general ability tests would not feature on this scale. Although no significant difference occurred between the scores obtained by the experienced and inexperienced tester, these correlations tend to indicate that the objectivity of fielding and general ability tests were not entirely acceptable. However, what must be taken into account are the factors, previously discussed, which may reduce the correlation coefficient (Clarke and Clarke 1970). Furthermore, a degree of learning does take place between the first and second tests as will be discussed later. This learning factor would vary from individual to individual. This fact is further illustrated in Table V (p. 93) where the mean values for all four tests that were conducted second were equal to or greater than the mean values for the tests conducted first, although not significantly so. To illuminate this factor, the tests should either be conducted twice, or practice trials should be allowed at each test (Clarke 1976). The batting and bowling tests showed greater correlation coefficients which may be due to the fact that the test procedures used are very similar to accepted practice methods of many successful players (Greig 1974, Sheppard 1975, Willis 1978).

Thus, taking into account these factors it is the author's contention that these four tests, used in conjunction with subjective evaluations, are objective enough to assist the coach with the evaluation of the players in his team.

Table IV: Group means and standard deviations for cricket skills scores obtained by the experienced and inexperienced testers

	Group A (n = 23)		Group B (n = 21)	
	Test 1	Test 2	Test 1	Test 2
Batting				
Experienced Tester	59 ±11,47			59 ±10,83
Inexperienced Tester		65 ±9,61	56 ±12,37	
Bowling				
Experienced Tester	54 ±11,29			59 ±12,31
Inexperienced Tester		56 ±11,11	57 ±10,96	
Fielding				
Experienced Tester	73,1 ±5,62			75,2 ±5,14
Inexperienced Tester		76,4 ±3,65	75,4 ±6,93	
General Ability				
Experienced Tester	57,0 ±7,71			55,7 ±5,37
Inexperienced Tester		58,7 ±7,03	55,8 ±7,78	

Table V: Means and standard deviations for cricket skills scores obtained by experienced tester, inexperienced testers, and the tests conducted first and second (n = 44).

	Batting	Bowling	Fielding	General Ability
Experienced Testers				
$\bar{X}$	59	56	74,1	56,4
SD	11,04	11,94	5,44	6,65
Inexperienced Testers				
$\bar{X}$	61	56	75,9	57,3
SD	11,68	10,91	5,43	7,45
First Evaluation				
$\bar{X}$	58	55	74,2	56,4
SD	11,86	11,10	6,31	7,67
Second Evaluation				
$\bar{X}$	62	58	75,9	57,3
SD	10,54	11,63	4,41	6,39

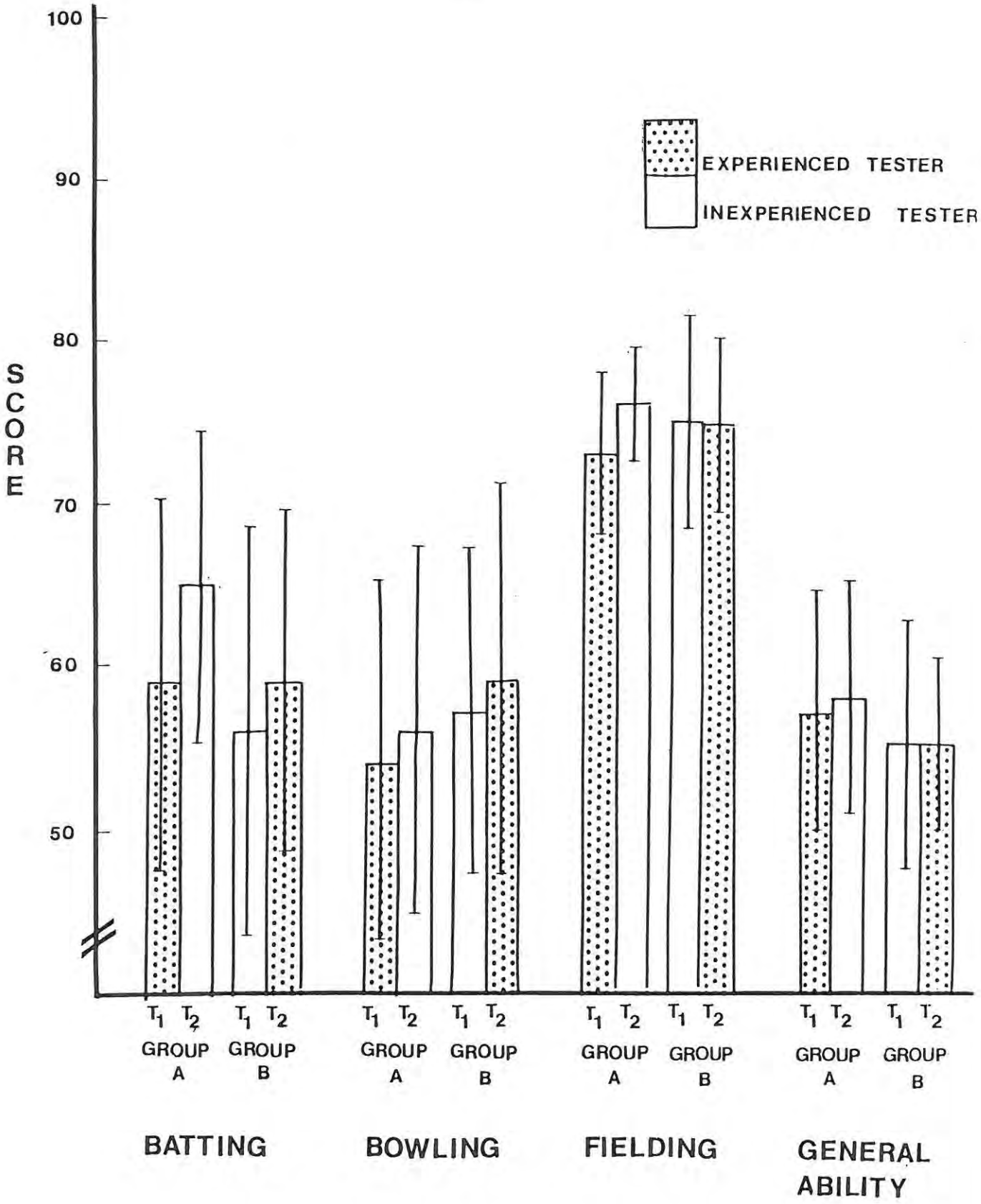


Figure 25: Means and standard deviations for cricket skills scores obtained by the experienced and inexperienced testers (Group A n = 23; Group B n = 21).

Reliability

To determine whether the objective tests would be reliable when administered at different times, a group of 23 subjects was tested on five consecutive days. The means and standard deviations for the five tests are set out in Table VI (p. 96) and Fig. 26 (p. 97).

Statistically no significant differences were found between the first (T_1) and second (T_2) administration of the four sports skills tests. When the scores obtained in T_1 were correlated with those in T_2 the following significant ($p < 0,05$) correlation coefficients were found: Batting 0,59; Bowling 0,85; Fielding 0,75 and General Ability 0,83. The Sports Skills Test Project of the American Alliance for Health, Physical Education and Recreation recommend a minimum reliability coefficient of 0,70 for skills scored on the basis of accuracy and form (Collins and Hodges 1978). From this it can be accepted that the Bowling, Fielding and General Ability tests are all reliable tests. In the batting test accuracy, as well as moving fast to get into the correct position to play the next stroke, plays an important part. With the increase in speed of movement it is obvious that accuracy will decrease.

The test - re-test method was used to determine the reliability coefficient in this study. According to Collins and Hodges (1978), Eckert (1974), Franks and Deutsche (1973) and Johnson and Nelson (1979) systematic changes are not accounted for using this method. This may result in a greater chance of

Table VI: Comparison of cricket skills scores obtained through repeated evaluations (n = 23).

	Test 1	Test 2	Test 3	Test 4	Test 5
Batting					
$\bar{X}$	68	72	72	73	73
SD	11,60	8,84	7,95	5,83	6,17
Bowling					
$\bar{X}$	58	61	61	61	60
SD	13,34	12,28	11,20	11,09	11,84
Fielding					
$\bar{X}$	72,1	74,1	76,7	77,5	76,8
SD	6,13	7,10	6,75	5,65	5,58
General Ability					
$\bar{X}$	58,1	57,8	61,2	60,9	60,8
SD	6,57	5,95	5,51	6,41	4,47

* Significant difference at the five percent level ($p < 0,05$).

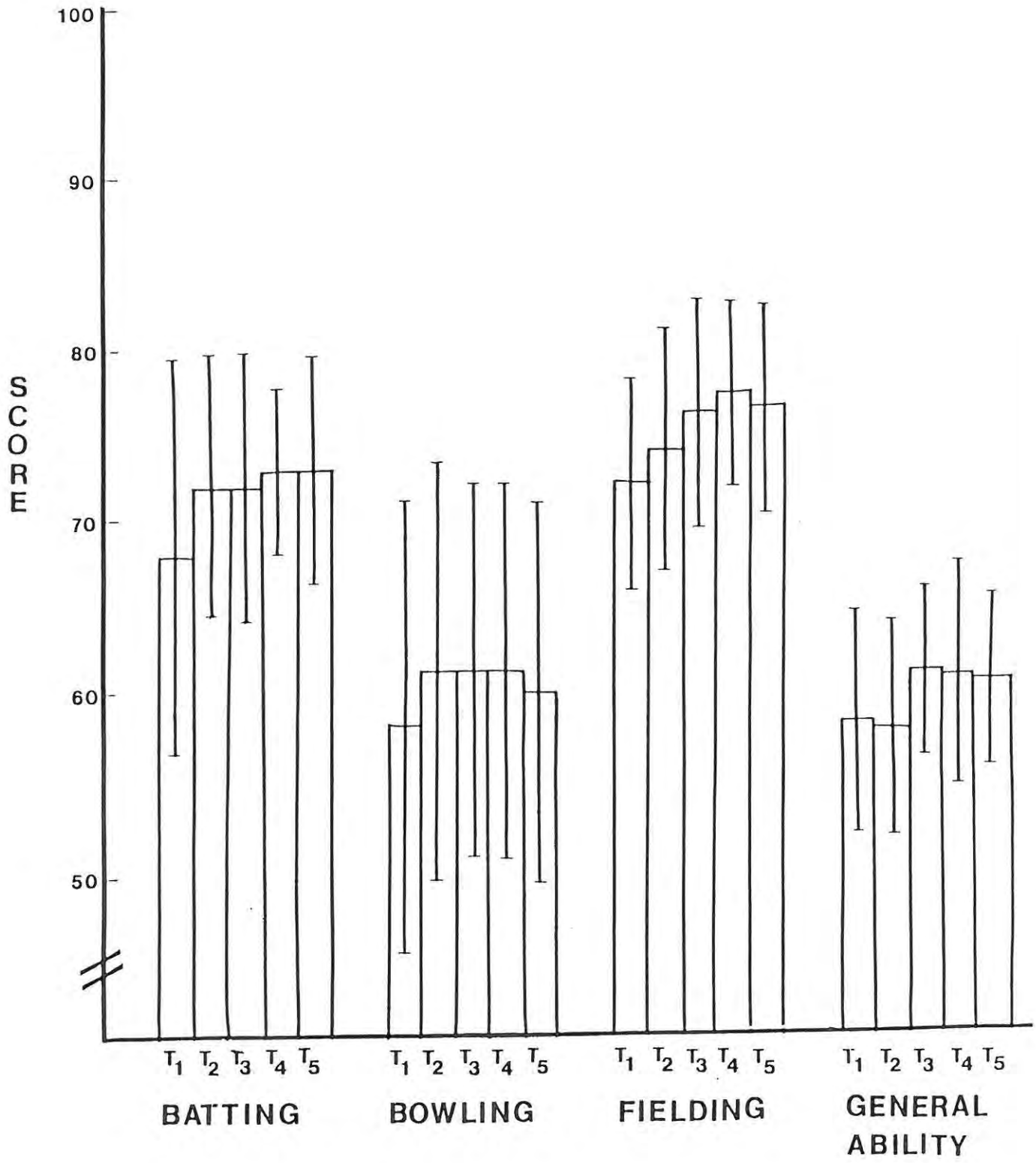


Figure 26: Comparison of cricket skills scores obtained through repeated evaluations (n = 23).

deviation in performance and thus a lower reliability coefficient. Furthermore, Feldt and McKee (1958) found that the reliability coefficient may be lowered due to day-to-day fatigue conditions, bodily health, mental attitude and the level of motivation. Thus it is the author's opinion that a lower reliability coefficient would be acceptable in all the tests.

It is evident from Fig. 26 that most change in the batting and bowling tests occur between T_1 and T_2. When the differences between the subsequent tests were expressed as percentages of the first of the two tests it was found that there was an improvement of 5,9% between T_1 and T_2 of the batting tests. The only other differences between the subsequent tests was between T_3 and T_4 (1,4%). In the bowling test 5,2% improvement occurred between T_1 and T_2. The only other difference occurred between T_4 and T_5 (1,6%). From this it is evident that in the batting and bowling tests a learning factor has its greatest effect between T_1 and T_2.

In the fielding test an increase of 2,8% occurred between T_1 and T_2. However, an increase of 3,5% occurred between T_2 and the third administration (T_3). This gives a total increase of 6,3% between T_1 and T_3. The subsequent tests showed very slight changes. In the general ability test a difference of 0,5% occurred between T_1 and T_2. However, T_2 and T_3 showed an increase of 5,9%. From this it is evident that in the fielding and general ability tests a learning factor has its greatest effect between T_2 and T_3.

When the four tests were examined as a whole, it was found that a total increase of 14,4% was found between T_1 and T_2. A total increase of 9,4% occurred between T_2 and T_3 for the four tests. From this it is evident that the greatest learning factor is to be found between T_1 and T_2.

From this it can be seen that the four tests are reliable but only if an extended period of practice is allowed at each test or the tests are conducted twice and the score obtained in the second testing session is taken as the player's score.

To assist the coach to categorize the players into homogeneus groups based on the scores obtained in the sports skills tests of batting, bowling, fielding and general ability, a table of norms was constructed. This table was constructed using the decile scale based on the 6-Sigma scale (Clarke and Clarke 1970). The mean and standard deviations of each of the batting, bowling, fielding and general ability tests were utilized to make the tests more meaningful. This would enable the player to compare his score in one test to that of another. In addition his score in relation to anothers may be compared. The figures have been rounded off for convenience. Thus, using Table VII (p. 100) a reasonably accurate assessment of cricket batting, bowling, fielding and general ability can be made from the scores obtained in the sports skills tests.

Table VII: Norms, based on the 6-Sigma Scale by mean standard deviation process in deciles, for the cricket batting, bowling, fielding and general ability tests.

Classification	Score			
	Batting	Bowling	Fielding	General Ability
Excellent	Over 82	Over 77	Over 85	Over 74
Good	74 - 81	70 - 76	80 - 84	67 - 73
Above average	67 - 73	64 - 69	75 - 79	60 - 66
Average	51 - 66	50 - 63	66 - 74	47 - 59
Below average	44 - 50	44 - 49	62 - 65	40 - 46
Weak	36 - 43	39 - 43	57 - 61	33 - 39
Very weak	Under 35	Under 38	Under 56	Under 32

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A considerable amount of a coach's time is spent developing skills, identifying talent and gaining knowledge of the potential abilities of his players. Due to the nature of cricket, the evaluation of a player's ability is very difficult to accurately assess. This evaluation is invariably based on a subjective evaluation of the player at a practice or during the match situation. The purpose of this study, then, was to devise and assess the accuracy of a battery of evaluative tests by which batting, bowling, fielding and general ability could be objectively assessed.

Summary of procedures

To test the validity of the devised tests, 155 players were first subjectively assessed by the coach of their team and the author. Each player was assessed according to a set of guidelines. Each assessment was made out of 100. Having done this, they were all evaluated objectively by the author using the cricket skills tests.

To determine whether the four tests would be objective when administered by various testers, an experienced and four inexperienced testers conducted the sports skills tests on four teams of players. The experienced tester, the author, first assessed two of the teams (Group A). These two teams were then assessed by their coaches who were regarded as

inexperienced testers as they had no previous experience of conducting sports skills tests. The other two teams (Group B) were first assessed by their coaches, the inexperienced testers, and then by the experienced tester, the author.

To determine whether the objective tests would be reliable when repeatedly administered by the same tester, a group of subjects was tested on five consecutive days.

Statistical analysis of these data was performed in order to determine the validity, reliability and objectivity of the tests.

Summary of the results

When testing the validity of the tests the following results were found:

1. The batting, fielding and general ability scores for the subjective and objective assessments differed significantly ($p < 0,05$). No significant difference was found between the scores obtained for bowling.
2. Pearson Product-Moment correlation coefficients between the subjective and abjective test results were all significant ($p \leq 0,05$) and ranged between 0,43 and 0,81.
3. The frequency distributions for the subjective and objective tests show that the objective tests tend to spread the scores out more, especially at the extremes of the scale.

When testing the objectivity of the tests the following results were found:

1. No significant differences ($p < 0,05$) were found between the scores for the experienced and the inexperienced testers.
2. Pearson Product-Moment correlation coefficients between the scores obtained by the experienced and the inexperienced testers were all significant ($p < 0,05$). These values ranged from 0,41 to 0,78.
3. The mean scores obtained in the second testing procedure were all equal to or greater than the values for for the tests conducted first. These differences, however, were not found to be significant ($p < 0,05$).

When testing the reliability of the tests the following results were found:

1. No differences ($p < 0,05$) were found between T_1 and T_2. Significant differences did occur between the first test and subsequent tests in batting, fielding and general ability. In the general ability test significant differences also occurred between T_2 and subsequent tests.
2. Pearsons Product-Moment correlation coefficients between T_1 and T_2 were all significant ($p < 0,05$). These values ranged from 0,59 to 0,83.
3. When the differences between two tests were expressed as a percentage of the first of these tests, it was found that the total differences of the four tests were greatest between T_1 and T_2.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

1. The objective tests are valid tests of cricket playing ability.
2. These tests are reliable when administered by various testers.
3. These tests are reliable when repeatedly administered by one tester, if sufficient pre-test practice is allowed.

Recommendations

The following recommendations are presented for further study:

1. The subjects should be allowed an extended practice period at each test prior to taking part in the test or the tests should be conducted twice, with the second tests counting. It is felt that the more familiar the subjects become with the tests the less the learning differences would be.
2. A more sensitive scoring system for fielding and general ability should be devised. This would then allow a still greater differentiation to be made between the various players and as a result the tests would be of even greater assistance to the coach when assessing his players.

REFERENCES

Abernethy, B. (1981) Mechanism of skill in cricket batting. Australian Journal of Sports Medicine, 13 (1), 3-10.

Arlott, J. and Trueman, F. (1977) Arlott and Trueman on Cricket. Morrison and Gibb Ltd., London.

Bland, C. (1969) Dynamic Cricket. The College Press, Rhodesia.

Baumgartner, T.A. and Jackson, A.S. (1975) Measurement for Evaluation in Physical Education. Houghton Miffin Company, Boston.

Bowers, C.O., Fie, J.K. and Schmid, A.B. (1981) Judging and Coaching Woman's Gymnastics. 2nd edition. Mayfield Publishing Company, California.

Campbell, W.R. and Tucker, N.M. (1967) An Introduction to Tests and Measurement in Physical Education. G. Bell and Sons Ltd., London.

Clarke, H.H. (1976) Application of Measurement to Health and Physical Education. 5th edition. Prentice-Hall Inc., New Jersey.

Clarke, D.H. and Clarke, H.H. (1970) Research Processes in Physical Education, Recreation and Health. Prentice-Hall Inc., New Jersey.

Cohen, L. and Holliday, M. (1979) Statistics for Education and Physical Education. Harper and Row Publishers, London.

Collins, D.R. and Hodges, P.B. (1978) A Comprehensive Guide to Sports Skills Tests and Measurement. Charles C. Thomas Publishers, Illinois, U.S.A.

Cooke, J.C. (1955) The boundary layer and seam bowling. Mathematics Gazette, 39, 196.

Daish, C.B. (1972) Ball Games - The Sportsman's Guide to Impact, Swing, Stroke, Rolling and Bounce. The English University Press Ltd., London.

Davis, K. and Blanksby, B. (1976a) A Cinematographic Analysis of Fast Bowling in Cricket. The Australian Journal for Health, Physical Education and Recreation, 71 (3), 9 -15.

Davis, K. and Blanksby, B. (1976b) The Segmental Components of Fast Bowling in Cricket. The Australian Journal for Health, Physical Education and Recreation, 71 (3), 6-8.

Eckert, H.M. (1974) Practical Measurement of Physical Performance. Lea and Febiger, Philadelphia.

Feldt, L.S. and McKee, M.E. (1958) Estimation of the reliability of skills tests. Research Quarterly, 29 (3), 279.

Ferguson, G.A. (1981) Statistical Analysis in Psychology and Education. 5th edition. McGraw-Hill Book Company, New York.

Fletcher, J.G. (1955) Calories and Cricket. Lancet I, 1165-1166.

Franks, B.D. and Deutsche, H. (1973) Evaluating Performance in Physical Education. Academic Press, Inc., New York.

Greig, T. (1974) Greig on Cricket. Stanley Paul Co. Ltd., London.

Hardman, K. (1978) The concept of assessment. In Assessment of Physical Education in Schools and Colleges, Inaugural Conference of the British Council of Physical Education. I.K. Glaister (Ed.) Taylor Young Printers Ltd., Cheltenham.

Hookes, G.E. (1959) Prediction of baseball ability through an analysis of measures of strength and structure. Research Quarterly, 30 (1), 38-43.

Johnson, B.L. and Nelson, J.K. (1979) Practical Measurements for Evaluation in Physical Education, 3rd edition. Burges Publishing Company, Minnesota.

Lyttleton, R.A. (1957) The swing of a cricket ball. Discovery, 18, 186.

M.C.C., the (1976) The M.C.C. Cricket Coaching Book. William Heinemann Ltd., London.

McGraw, L.W. and Tolbert, J.W. (1952) A comparison of the reliability of methods of scoring tests of physical ability. Research Quarterly, 23 (1), 73-81.

Miller, K. and Whitington, R.S. (1953) Bumper. Latimer House Ltd., London

Osborne, M.M. and Gordon. M.E. (1972) An investigation of the accuracy of ratings of a gross motor skill. Research Quarterly, 43 (1), 55-61.

Passmore, R. and Durnin, J.V.G.A. (1967) Energy, Work and Leisure. Heinemann Education Books Ltd., London.

Penrose, T., Foster, D. and Blanksby, B. (1976) Release velocities of fast bowlers during a Cricket Test match. The Australian Journal for Health, Physical Education and Recreation, 71 (3), 1-5.

Pollock, P. and Pollock,G. (1968) Bouncers and Boundaries. Sportsman Enterprise (Pty) Ltd., Johannesburg.

Robinson, R. (1975) On Top Down Under: Australian Cricket Captains. Cassell Australia Limited.

Schurr, E.L. (1967) Movement Experiences for Children: Curriculum and Methods for Elementary School Physical Education. Prentice-Hall Inc., New Jersey.

Sheppard, J. (1975) Cricket - More than a Game. Angus and Robertson (U.K.) Ltd., London.

Start, K.B. (1962) A look at the boundaries for the "swing" of a cricket ball. The Australian Journal of Physical Education, 26, 9-16.

Stretch, R.A. (1983) An objective test to evaluate batting, bowling and fielding ability in cricket. Education Journal, 93 (2), 39-46.

Stroup, F. (1955) Game results as a criterion for validating basketball skill test. Research Quarterly, 26 (3), 353-357.

Sutcliffe, P. (1975) Teaching Cricket Simply. Lepus Books.

Thomas, M. (1978) Assessment in games. In Assessment of Physical Education in Schools and Colleges, Inaugural Conference of the British Council of Physical Education. I.K. Glaister (Ed.) Taylor Young Printers Ltd., Cheltenham.

Tyler, M. (1975) Encyclopedia of Sport. Marshall Cavendish, London.

Verducci, F.M. (1980) Measurement Concepts in Physical Education. The C.V. Mosby Company, London.

Walker, P. (1978) Cricket Conversations. Pelham Books Ltd., London.

Weber, J.C. and Lamb, D.R. (1970) Statistics and Research in Physical Education. C.V. Mosby Company, Saint Louis.

Whiting, H.T.A. (1979) Acquiring Ball Skills. Bell and Hyman, London.

Willis, B. (1978) Pace Bowling. Pelham Books Ltd., London.

APPENDICES

APPENDIX A: Letter sent to the headmasters of the schools requesting permission to conduct the sports skills tests at their schools.

103 Queens Road
King William's Town

13 October 1983

Dear

I am at present studying part-time for my Masters Degree through Rhodes University. I am improving and expanding a research project which I did as part of my Honours course. An article in this respect was published in THE EDUCATION JOURNAL, September,1984.

In order to validate and test the reliability of these tests I need to assess as many subjects as possible and would appreciate it if you and your coaches would be of assistance. All that is required, is my attendance at a net practice where the coach of the particular team and I would subjectively assess each player on his batting, bowling and fielding ability. After this practice I would like to administer the four tests to the players. This evaluation on a team of players should only take about thirty minutes. I supply all the necessary apparatus and only require an area approximately a quarter the size of a cricket field in order to conduct these tests.

I would be pleased if you could let me have the dates and times which would suit your coaches and players so that I may plan my testing programme. I have enclosed a copy of the four tests for your interest.

Thanking you in anticipation and hoping to hear from you at your earliest convienience.

Yours sincerely

Richard A. Stretch

APPENDIX B: Results of the pilot testing which preceded the data collection in the present study. (Copy of the article appearing in The Education Journal, September, 1983).

AN OBJECTIVE TEST TO EVALUATE BATTING, BOWLING AND FIELDING ABILITY IN CRICKET

by

Richard A. Stretch

Term opens on Tuesday; first practice is on Wednesday; the first match is on Saturday; "Sir, my mother wants to know if I will be playing on Saturday?"; they are all complete strangers. How does a coach begin to assess playing ability in these circumstances? How can a coach help 15 - 20 energetic boys feel that the team for Saturday has been selected on a reasonably fair basis? "Sir, my dad says that he will give lifts if I am playing on Saturday." We are all familiar with the problems. Richard Stretch gives us a good starting point. In adopting this methodical approach many a desperate cricket coach could find the educational value of the game beginning to emerge. And that could be most enjoyable.

1. Introduction

Down the years many attempts have been made to devise tests by which an individual's skill or ability can be measured in a particular sport. The win-loss record of the subjects, subjective evaluation by experts, aesthetic evaluation or objective evaluation are all methods used to evaluate players. A cricket player's ability is usually judged by comparing his batting and bowling average to that of other players. However. a wide variety of factors make this an undesirable means of evaluating cricketing skill or ability.

This study was conducted to devise a battery of tests by which the evaluation of cricketing skills could be more accurately measured, and by which the coach could divide large groups into homogeneous groups. A further reason for drawing up these tests was to demonstrate to young players how easy it is to evaluate their own performances and to provide easy and interesting methods, which require the minimum of apparatus, organization and time, to practice the basic skills of Cricket on their own. Thus the feedback from these tests would be a form of motivation to the players to improve.

What must be kept in mind is that objective tests only evaluate the particular skill involved and do not measure the player's ability to adapt to various game situations which often require rapid decisions to be made without time to weigh up the pros and cons of each situation. Various skills within each aspect of batting, bowling and fielding are required depending on the position in the team and the situation of the game. Unfortunately, objective tests are not able to evaluate these various aspects nor are they able to measure important psychological factors such as attitude, motivation, personality and adjustment to stress, which play a vital role in the match situation. However, if the selection of the desirable from the undesirable is left to the judgment of the coach, it will obviously vary according to his ability in that respect. An objective test, used in conjunction with the coach's subjective ratings, may well reduce the number of errors in the assessment of players and the selection of teams.

2. Methods

The subjects used for this study were thirty-seven pupils and students of three schools and one university in Grahamstown. All players were first team players and it was the author's contention that there would be a wide range of ability levels in each aspect to be tested as there were batsmen tested who never bowled in matches and bowlers who were selected purely as bowlers. The author conducted the objective skill tests on his own, while he was assisted by coaches of the teams in doing the subjective evaluation. All the coaches involved have the first coaching certificate from the South African Cricket Union.

The mean and standard deviation was computed using the Hewlett-Packard 34c statistical programme, while the 'student' t-test was used to compare the mean scores of the subjective and objective tests for batting, bowling and fielding. Pearson's Product — moment correlation co-efficient was used for the computation of simple correlation matrices between the scores for the subjective and objective tests.

A. Batting

In the batting test a $5\frac{1}{2}$ ounce leather ball is balanced on a tee $\pm$ 15 cm off the ground. A plastic fruit juice bottle was used in this study. Six stumps are placed in the ground 25m away from the ball (Fig. 1). The six stumps are placed in the ground in a straight line with A being O,71m (1 stump length), B, C. D. and E being 1,42m (2 stump lengths) apart.

A scorer is required to observe between which wickets the batsman hits the ball using a cricket bat, and to record the score. The batsman must take up his normal stance behind the ball. He then steps forward and hits the ball as he would hit a straight drive. He must aim to hit the ball between the stumps. If he hits the ball through A he scores 10 points, through B or C he scores 6 points and through D or E he scores 4 points. Any balls that pass outside of the stumps do not score any points. If a ball strikes a stump and does not pass through then it it is counted as having gone through and the batsman receives the higher score. Each batsman is given ten attempts, to give him a possible score out of 100. The batsman's score can be compared to the norms.

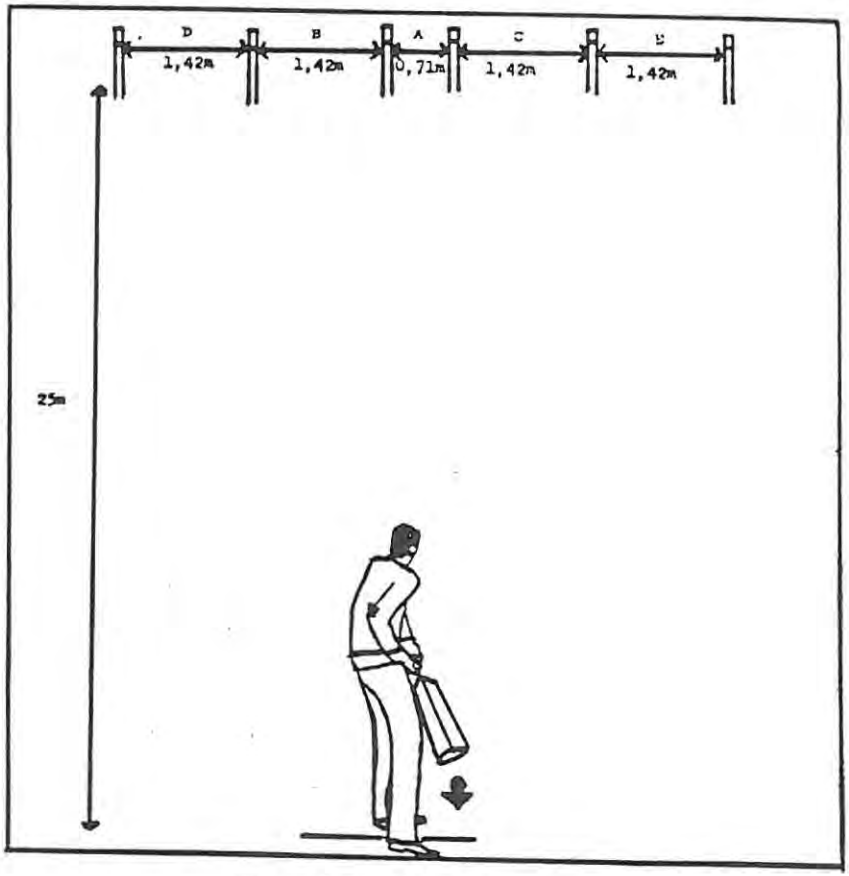


Figure 1: Plan for the batting test

B. Bowling

A 5½ ounce ball is used for the bowling test. The target areas are marked off on the pitch as shown in Fig. 2. On a turf wicket the areas can be marked off using a length of string and 4 nails for each target area. On artificial pitches these areas can be marked off with the white chalk or again using string which is held down at the corners using presstik. A scorer is required to observe in which target area the ball pitches, and to record all ten scores on the score sheet. The bowler may bowl over or round the wicket with an over-arm action. It is essential that he bowls as he would in a match or at practice. He delivers ten balls, aiming at the target area on the pitch. If the ball pitches in target area A he scores 10 points, in B he scores 6 points and any ball not pitching in either A or B scores 4 points. If the ball pitches on a boundary line of a target area then it is counted as a good delivery.

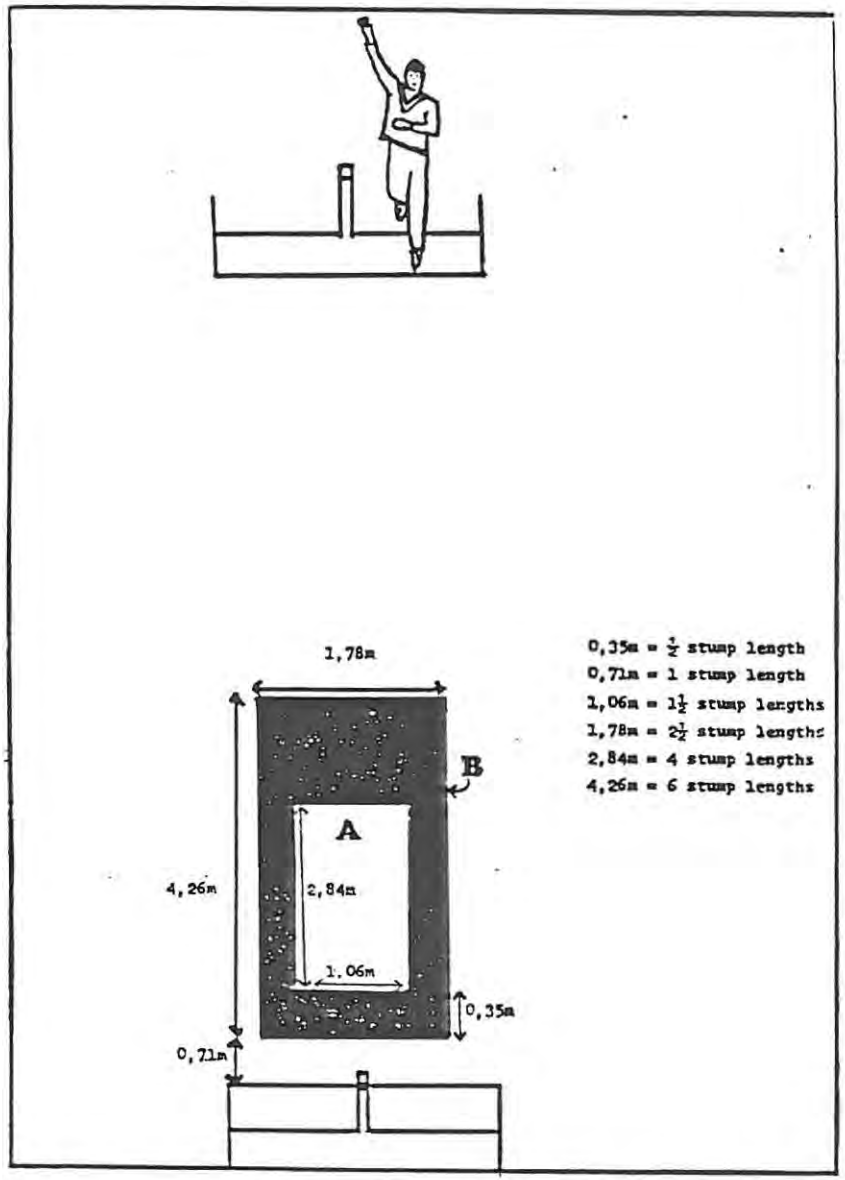


Figure 2: Plan for the bowling test

C. Fielding

Six 5½ ounce balls are placed at points B, C, D, E, F and G as shown in Figure 3. These points should be marked with lime or a bean bag to ensure that the balls are placed in the correct place each time. The scorer holds a seventh ball, a stopwatch and the score card in his

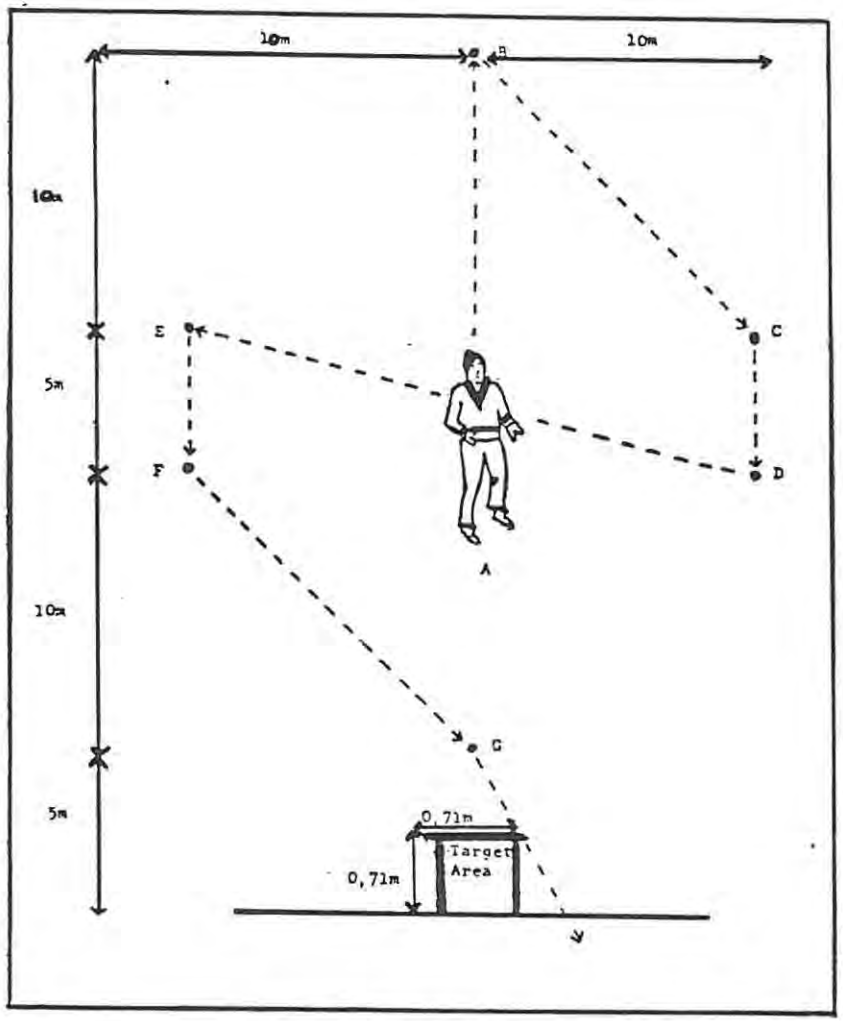


Figure 3: Plan for the fielding test.

hands. He positions himself in such a way that he will be able to judge whether the fielded balls have passed through the target area and to reconstruct the target area quickly if it is knocked over. The target area consists of two stumps placed in the ground so that a third stump may be balanced on top of them. If the ball knocks the stumps over the scorer must reconstruct the target area while the fielder continues. The ball is allowed to bounce before passing between the stumps. The fielder stands at position A. The time-keeper throws a ball approximately 10m into the air so that it comes down as close to the fielder as possible. He catches the ball and returns it at the target area as quickly as possible. The timekeeper begins timing once the ball touches the fielder's hands. If the fielder drops the ball he has to retrieve it while the timekeeper continues timing. Having returned the first ball he now turns and returns the ball at B. He then returns the balls at C, D, E and F, in that order, once again using the over-arm throw. From F he runs in, picks up and returns the ball at G with an under-arm throw. Having done this he sprints past the target area. Once he crosses the line at the target area the timekeeper stops his watch and reads off the time in seconds. A left-handed fielder would move from B to E, F, C, D and then G, in that order.

The scorer records the fielder's time to the nearest second. For each throw that did not pass through the target area, and for a dropped catch, a penalty of 3 seconds is added on to the time taken to give him his total time taken. This time is then subtracted from 100 to give him a score out of 100.

3. Results and discussions

When the thirty-seven subjects, with a mean age of 18,1 years, were evaluated a high correlation was found between the objective and the subjective evaluations for batting (0,71) and bowling (0,79) (Appendix A). These correlations were found to be significant at the one percent level (Cohen and Holliday, 1979). A modest correlation of 0,67 was found for the fielding test. These findings indicate that the tests are good measures of the players' abilities in batting, bowling and fielding, with the latter test not being as good a measure as the first two. In the fielding test a penalty of three seconds is added onto the time taken for each throw which does not pass through the target area. If all throws were unsuccessful it would constitute 21% of the total possible score (100). The accuracy of the throw plays an important part in fielding and this penalty was included so as to relate this test as closely as possible to the actual match situation.

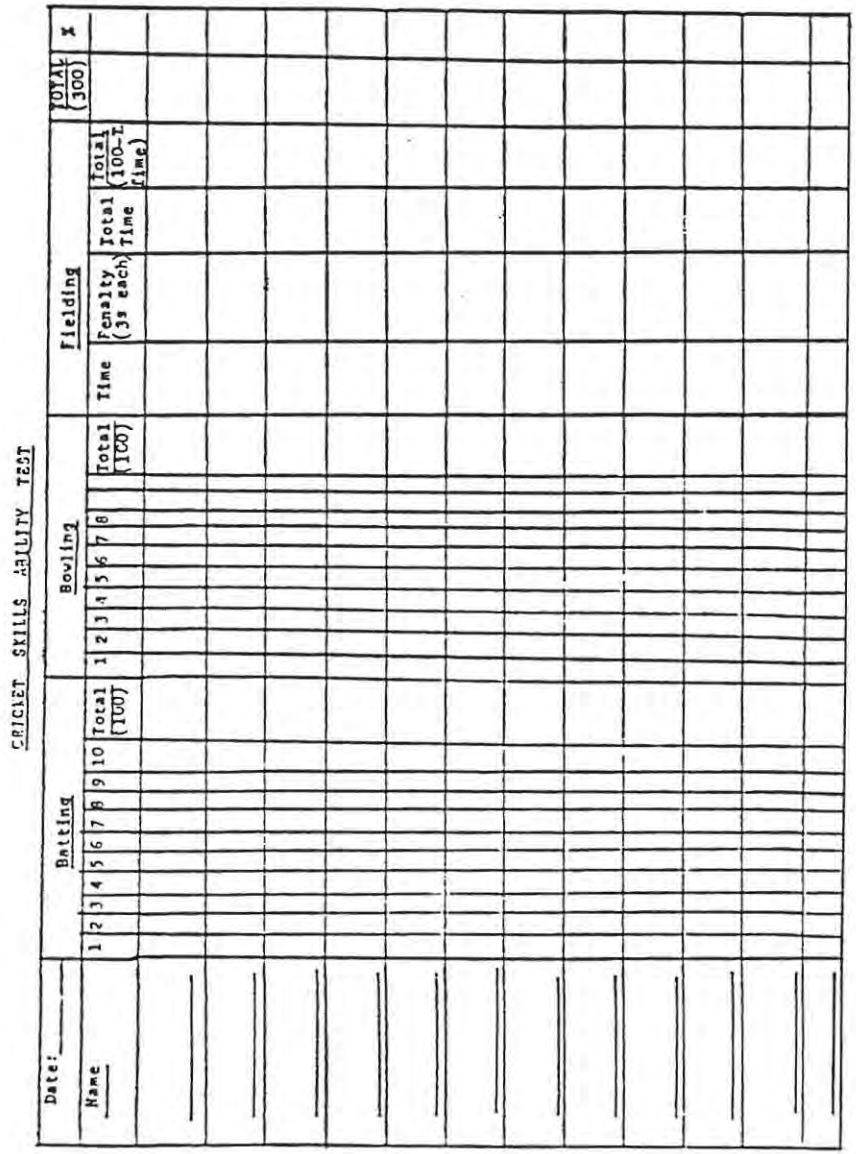
TABLE I: Means values and Correlation for the objective and subjective evaluations

	Objective	Subjective	Correlation
Batting	57,6	58,2	0,71
Bowling	67,8	63,1	0,79
Fielding	65,9	65,8	0,67
Total (%)	63,6	62,2	0,57

When the scores for the three tests were added together a modest correlation of 0,57 was found. This correlation is smaller than those for batting, bowling and fielding, which emphasises the difficulty facing a coach when he has to assess a player's over-all Cricket playing ability and divide players into teams using only subjective evaluation. The subjects had a mean score of 63,6 and 62,2 for the objective and subjective evaluations respectively (Table I). These scores would classify them in the lower half of the 'good' classification (Appendix B).

This was to be expected as these players all play for their school or university first teams. From Appendix B it can be seen that these players are rated as better bowlers and fielders than batsmen. This could be due to the fact that at a normal practice of one hour, all players bowl for approximately forty-five minutes and only bat for the remaining time, thus allowing the players to have more time to practice their bowling than their batting.

From these findings it is evident that these tests are a valid test of batting, bowling and fielding ability. These tests should also provide the coach with a simple and accurate method of assessing large groups of players with the intention of dividing them into homogeneous groups. In addition these tests should provide a simple method by which players of all levels are able to practise the basic skills of Cricket on their own.



APPENDIX A: Guide to correlations
(Cohen and Holliday, 1979)

0,00 — 0,19	a very low correlation
0,20 — 0,39	a low correlation
0,40 — 0,69	a modest correlation
0,70 — 0,89	a high correlation
0,90 — 1,00	a very high correlation

APPENDIX B: Norms for batting, bowling, fielding and general Cricket playing ability

Score	Classification
81 — 100	Exceptional
71 — 80	Excellent
61 — 70	Good
51 — 60	Average
41 — 50	Fair
0 — 40	Poor

Acknowledgements

A special note of appreciation is extended to the Human Sciences Research Council, without whose financial assistance this project would not have been possible.

Bibliography

Cohen, L., and Holliday, M., *Statistics for Education and Physical Education*, Harper & Row, London, 1979.

APPENDIX C: Instructions given to the inexperienced testers for the assessment of cricket skills

Summary of the Batting, Bowling, Fielding and General Ability Tests

General Organization

1. The following apparatus is required:
   16 cricket balls,
   1 ball in a sock,
   nylon twine to suspend ball (± 2m)
   2 bats,
   6 stumps,
   3 stopwatches,
   score-sheets and pencils.

2. The players are divided into four groups.

3. Each group is to have a score-sheet and pencil.

4. The positions are marked out, using lime or bean bags, for the placement of the balls for the fielding and general ability tests.

5. Each test is to be described in detail to the players - emphasising accuracy in scoring.

6. The players are to loosen up for each activity as they would in a match or practice.

7. The players are to act as scorers for other members in their groups.

8. The four groups are to work simultaneously.

9. After the completion of each test the players are to wait until all the groups have completed and recorded their scores. They are to change on the coach's command. While waiting for the other groups to complete, the players may begin loosening up for the next activity.

10. The tests should take approximately 30 minutes to complete on a group of 12 players.

11. The coach may make available a diagram for each test, as well as the scoring system, to avoid any unnecessary confusion.

Batting Test

1. The apparatus is set out as shown below with a ball in a sock suspended by thin nylon twine approximately 15cm above the ground. The stumps are placed 0,71m (one stump length) apart and 1,42m (two stump lengths) from the suspended ball.

2. The batsman takes up his position at the crease 0,71m (one stump length) from the suspended ball.

3. The scorer, with a stopwatch, takes up his position next to one of the stumps.

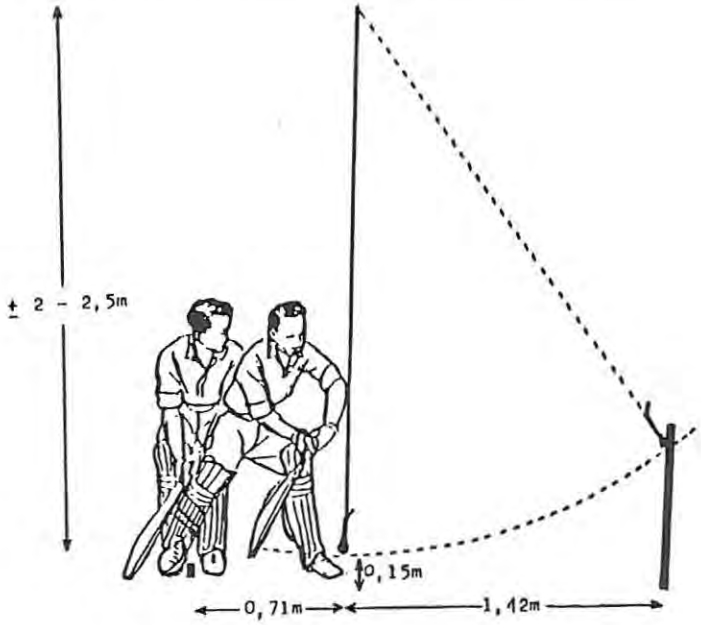
4. On the command to begin the batsman steps forward and hits the ball with a straight bat. He aims to hit the ball so that it swings through between the stumps.

5. He continues to hit the ball, with his back foot behind the crease, as it swings back to him.

6. A point is scored for each hit that passes between the two stumps as it swings away from the batsman. A point is not scored if the player's back foot is not behind the crease when he strikes the ball.

7. Each player bats for one session of 60 seconds.

8. The score the batsman obtains is entered on the score-sheet and multiplied by two to give the total score out of 100 for the batting test. The better the batsman the greater should be his score.



How to set up the apparatus and conduct the batting test.

Bowling Test

1. The apparatus is set out as shown below.

2. The bowler delivers ten balls aiming at the target area on the pitch.

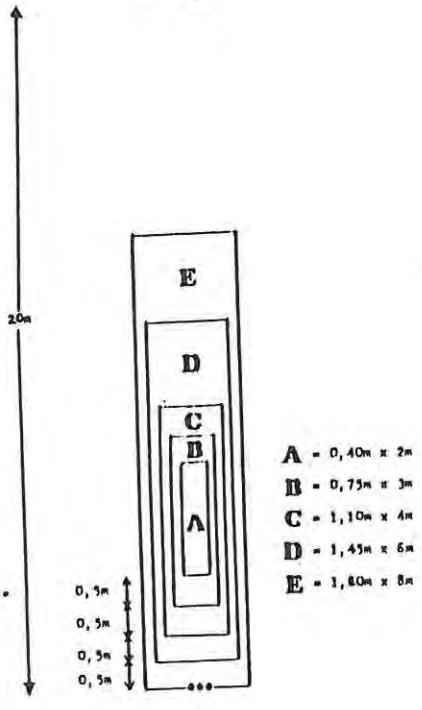
3. Any ball pitching on the boudary line of the target area is counted as a good delivery to the inner section (i.e. the higher score).

4. Points are scored for each ball pitching in the target area or boundary line as follows:

Target Area	Slow Bowlers	Medium and Fast Bowlers
A	10	10
B	8	10
C	6	8
D	4	6
E	2	4
Outside E	0	2

5. The bowlers in the group should bowl alternately, and record the score after each delivery.

6. The total score that the bowler obtains for the ten deliveries would be his score for the bowling test. The better the bowler, the greater should be his score.



How to set up the apparatus and conduct the bowling test.

Fielding Test

1. The apparatus is set out as shown below with balls placed at points B, C, D, E, F and G. The target area consists of two stumps placed in the ground 0,71m (one stump length) apart. If the ball knocks the stumps over the scorer must reconstruct the target area while the fielder continues.

2. The fielder stands at position A. The time-keeper throws the ball approximately ten metres into the air so that it comes down as close to the fielder as possible. He catches it and returns it over-arm at the target area as quickly as possible.

3. The time-keeper begins timing once the ball touches the fielder's hands. If the fielder drops the ball he has to retrieve it while the time-keeper continues timing.

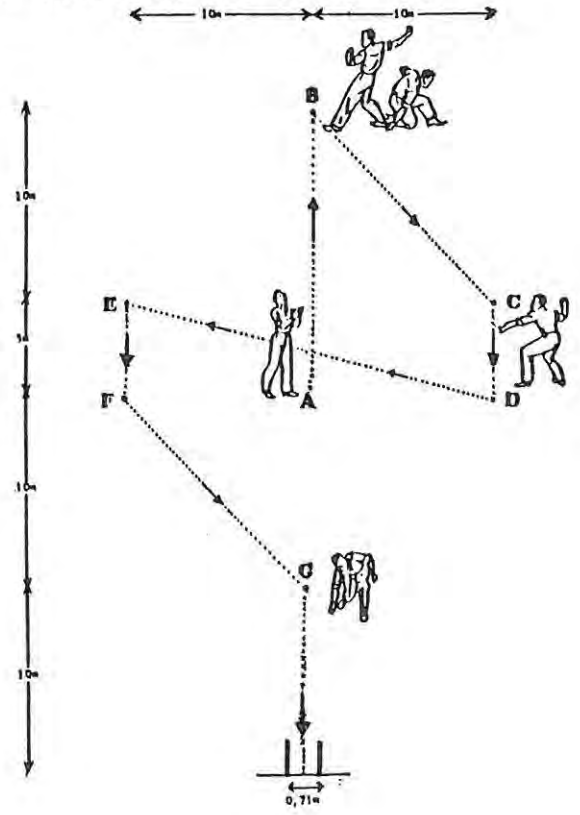
4. The fielder now returns the balls at B, C, D, E and F, in that order, using the over-arm throw.

5. From F he runs in, picks up and returns the ball at G with an under-arm throw.

6. He now sprints passed the target area. Once he passes the target area the time-keeper stops his watch and reads off the time to the nearest second.

7. A left-handed thrower moves from B to E, F, C, D and G, in that order.

8. For each throw that did not pass through the target area, and for a drop catch, a penalty of three seconds is added onto the time taken to give the fielder his total time. These would all be recorded on the score-sheet. The better the fielder the shorter should be the total time taken.



How to set up the apparatus and conduct the fielding test.

General Ability Test

1. The apparatus is set as shown below with a ball placed at points A, B, and C and three balls placed at D. The target area consists of two stumps placed in the ground 0,71m (one stump length) apart. If the ball knocks the stumps over, the scorer must reconstruct the target area while the fielder continues.

2. The player is to stand behind the start line. On the command to begin the time-keeper starts the watch and the player bounces the ball up and down on the bat, to a height of not less than 0,3m. Any ball that is not hit to a height of 0,3m or higher is not counted. If the ball falls to the ground the batsman has to pick it up and continue. After twenty-five successful hits up and down the player drops the bat and ball.

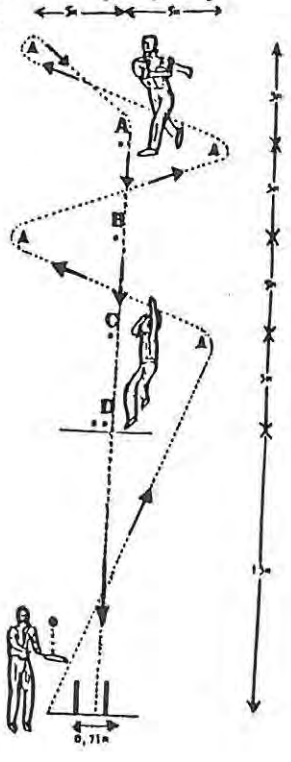
3. He now runs weaving around the stumps as shown in the diagram below.

4. When he gets to the ball at A he picks it up and throws it over-arm at the target area. He does the same with the ball placed at B and at C.

5. He then runs to D where he picks up the ball and bowls it, without a run-up, at the target area. He does the same with the two remaining balls. It is important that the player only picks up one ball at a time.

6. Once he has delivered the last ball he sprints across the finish-line and his time, to the nearest second, is recorded on the score-sheet.

7. For each ball that did not pass through the target area a penalty of three seconds is added onto the time taken to give the fielder his total time. These would all be recorded on the score-sheet. The better the player, the shorter should be the total time taken.



How to set up the apparatus and conduct the general ability test.

APPENDIX D: Score sheet used for the objective evaluation of batting, bowling, fielding and general ability skills in cricket.

Score sheet for the objective evaluations

Name	Batting		Bowling											Fielding Time + (Errors x 3s) = Total Time				General Ability Time + (Errors x 3s) = Total Time			
	Hits (60s)	Total	1	2	3	4	5	6	7	8	9	10	Total (100)	Time (T)	Errors (E)	(E x 3)	T + (E x 3)	Time (T)	Errors (E)	(E x 3)	T + (E x 3)

APPENDIX E: Score sheet used for the subjective evaluation of batting, bowling, fielding and general ability skills in cricket.

Score sheet for the subjective evaluations

Name	Date of birth	Batting	Bowling	Fielding	General Ability

APPENDIX F: Score sheet used for the repeated evaluations of of batting, bowling, fielding and general ability skills in cricket.

Score sheet for repeated objective evaluations

Name	Batting		Bowling											Fielding Time + (Errors x 3s) = Total Time				General Ability Time + (Errors x 3s) = Total Time			
	Hits (60s)	Total	1	2	3	4	5	6	7	8	9	10	Total (100)	Time (T)	Errors (E)	(E x 3)	T + (E x 3)	Time (T)	Errors (E)	(E x 3)	T + (E x 3
T_1																					
T_2																					
T_3																					
T_4																					
T_5																					
T_1																					
T_2																					
T_3																					
T_4																					
T_5																					

APPENDIX G: National Cricket Association Award Scheme for Proficiency in the skills of Cricket (Sutcliffe 1975).

Strokes

	To be played off
1) Pull	Back foot
2) On drive	Front foot
3) Straight drive	Front or back foot
4) Off drive	Front foot
5) Cover drive	Back foot
6) Cut	Back foot
7) Lofted drive	Front foot

Strokes 1 to 6. The ball must be struck so that it bounces at least once, before passing, with reasonable speed, between two markers, placed at a distance of 20 metres.

Stroke 7. The ball must pass between two markers, and carry beyond them before pitching. The markers are placed at the appropriate distance.

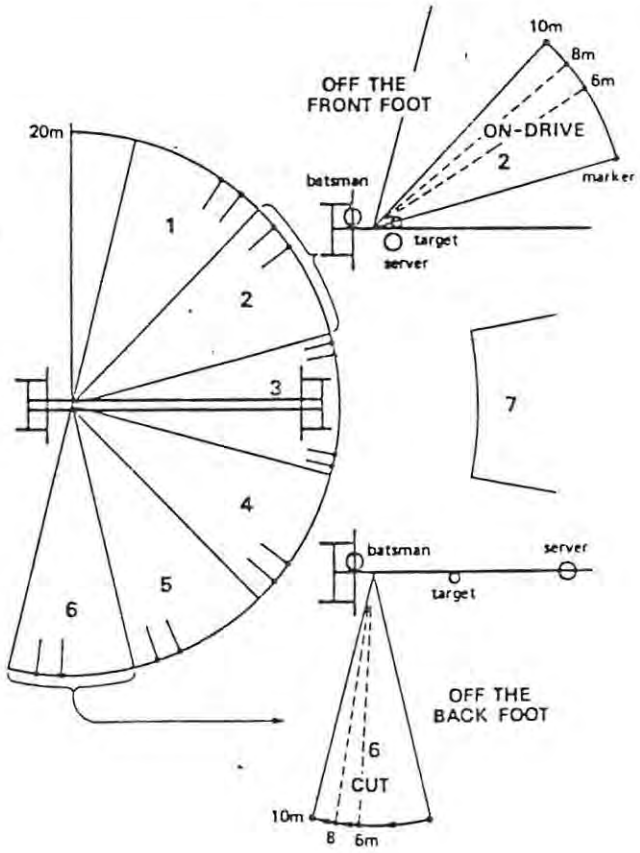
1st TEST Select three strokes, 10 attempts at each. One point each successful attempt. **Possible score**, 3 x 10 = 30 points. **Markers**, 10 metres apart, and for stroke 7, at a distance of 30 metres.

2nd TEST Select five strokes, 6 attempts at each. One point each successful attempt. **Possible score**, 5 x 6 = 30 points. **Markers**, 8 metres apart, and for stroke 7, 10 metres apart, at a distance of 40 metres.

FINAL TEST Select five strokes, 6 attempts at each. One point each successful attempt. **Possible score**, 5 x 6 = 30 points. **Markers**, 6 metres apart, and for stroke 7, 10 metres apart, at a distance of 50 metres.

SERVICE Front foot strokes, ball dropped vertically onto a target, one stride in front of the batsman and hit on the second bounce. Back foot strokes, ball thrown from a distance of approx. 10 metres onto a target approx. 5 metres away from the batsman.

It is recommended that a tennis ball is used for all tests.



BOWLING

Pitch

11 years of age and under	18 yards
12 and 13 years of age	20 yards
14 years of age and over	22 yards

Ball for Boys

13 years of age and under	4¾ oz.
14 years of age and over	5½ oz.

Ball for Girls

18 years of age and under	4¾ oz.
19 years of age and over	5 oz.

Plastic type for swing
Leather for spin *(recommendation only)*

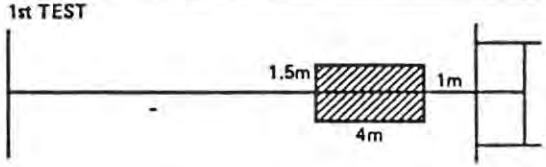
ALL TESTS Two overs to be bowled, best score to count. The bowler may bowl over or round the wicket with an overarm action.
An over is 6 consecutive deliveries.
Possible score per ball 5 points.
Possible score per over 6 x 5 = 30 points.

1st TEST Wicket, 5 stumps wide.
Target, 4m. x 1·5m., and 1m. in front of popping crease and centrally placed.
Score, 3 points for hitting target.
2 points for hitting wicket.

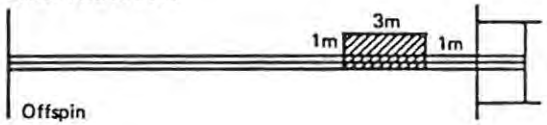
2nd TEST Wicket, 4 stumps wide.
Target, Offspin 3m. x 1m.
Legspin 4m. x 1m.
Outswing 3m. x 1m.
Inswing 3m. x 1m.
} placed as indicated
Score, 2 points for hitting target.
2 points for hitting wicket.
1 point for swing or spin.

FINAL TEST Wicket, 3 stumps wide.
Target, Offspin 3m. x 1m.
Legspin 4m. x 1m.
Outswing 3m. x 1m.
Inswing 3m. x 1m.
} placed as indicated
Score, as for 2nd Test.

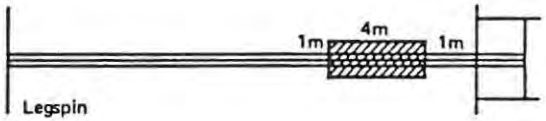
1st TEST



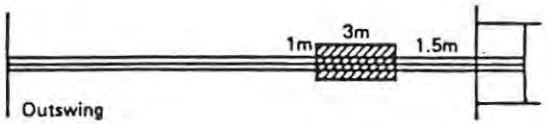
2nd & FINAL TEST



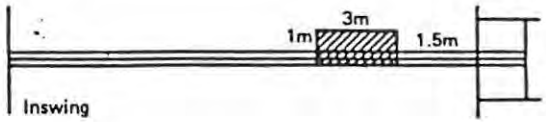
Offspin



Legspin



Outswing



Inswing

FIELDING

THE APPROPRIATE TEST IN EACH SECTION MUST BE ATTEMPTED

a **CATCHING.** Six consecutive attempts to catch a ball hit or thrown the appropriate distance.

1st Test 15m.–20m.		2nd Test 30m.–40m.		Final Test 5m.–50m.	
catches	points	catches	points	catches	points
6	10	6	10	6	10
5	8	5	8	5	8
4	6	4	4	4	4
3	4	3	2	3	0
2	2	2	0	2	0
1	0	1	0	1	0

b **FIRST TEST AND FINAL TEST. THROWING**

Six consecutive throws to pitch first bounce in a grid. Scoring as indicated, half the total score to count up to a maximum of 10 points, half points to be discounted.

SECOND TEST. GROUND FIELDING

A continuous effort to field six balls, which are fed in turn from a distance of 20m. The fielder moves in from a marker, fields and throws at a target, returns to his marker, and in for the next ball. The time is taken from the start to finishing back at the marker having fielded and thrown all six balls. A time allowance of 3 secs. is given for each throw which passes through the target with reasonable speed.

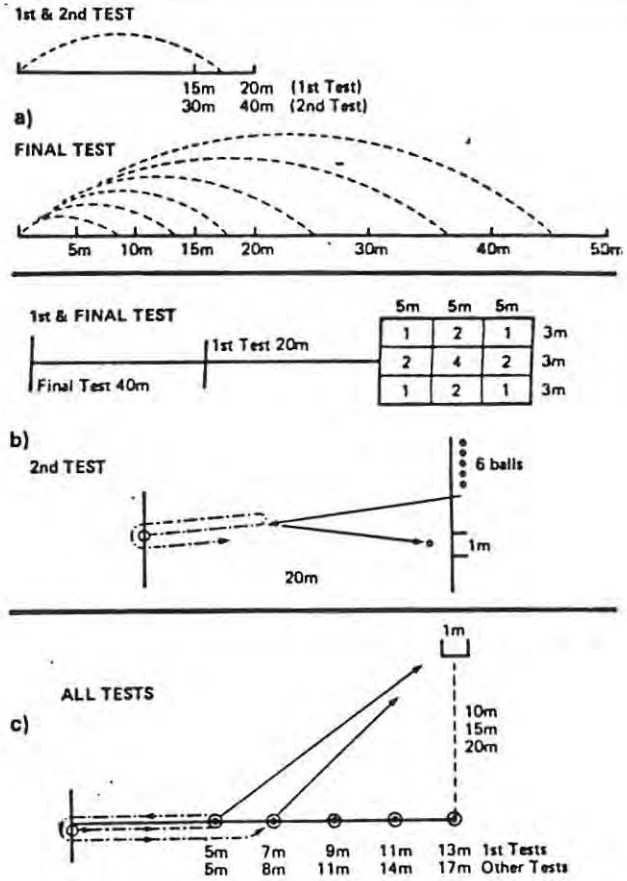
time secs.	points
< 20	10
20·1–25	8
25·1–30	6
30·1–35	4
35·1–40	2
> 40	0

c **ALL TESTS. TIMED SHUTTLE RUN**

Fielder is timed whilst running to pick up in turn, and throw at a target five balls, placed at appropriate distances, returning to his starting position each time before running to pick up the next ball. Time is taken from the start to the final return. A time allowance of 3 secs. is given for each throw which passes through the target with reasonable speed.

time secs	points
< 20	10
20·1–25	8
25·1–30	6
30·1–35	4
35·1–40	2
> 40	0

1st Test: Tennis Balls.
2nd and Final Test: Cricket Balls.



WICKET KEEPING

Equipment: Pads, gloves and inners, protector.

Where possible, wicket keeping test to be taken in conjunction with bowling tests.

1st TEST

a) Standing up or back. Take six consecutive deliveries before the ball pitches a second time.
b) Standing up. Take six returns from a distance 10m.–20m.
c) Starting from standing back, and moving up. Take six consecutive returns from a distance 20m.–30m..

2nd TEST

a) Standing up. Take six consecutive deliveries from a spin bowler.
b) Standing back. Take six consecutive deliveries from a seam bowler.
N.B. – For both these tests, a batsman to shadow strokes.
c) Starting from standing back, and moving up. Take six consecutive returns from a distance of over 30m. Two of these returns from behind the wicket.

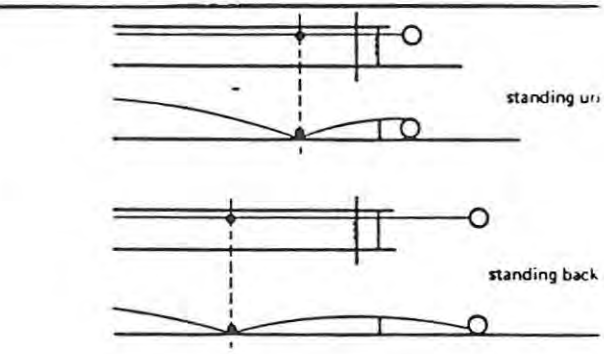
FINAL TEST

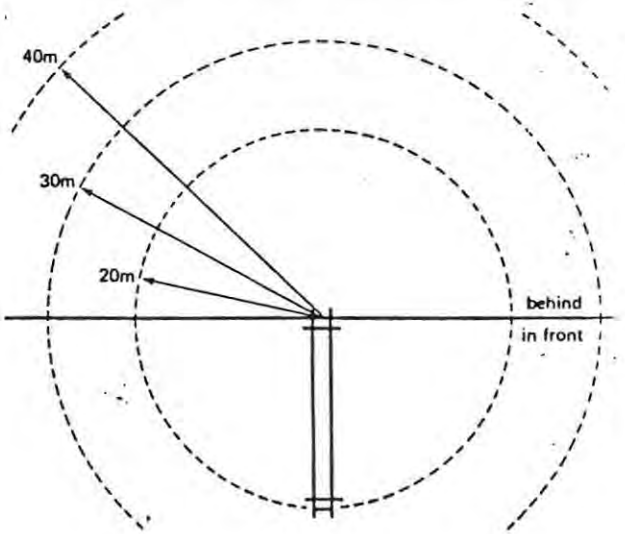
a) Standing up. Take six consecutive deliveries from a spin bowler, and remove the bails with a stumping action. Batsman shadowing.
b) Take six consecutive returns from a distance 20m.–30m.
c) Take six consecutive returns from a distance 40m.–50m.
N.B. – For b) and c) the keeper must take three returns when standing up, and three starting from standing back, two in each test being from behind the wicket.

In ALL TESTS any delivery or return which strikes the wicket does not count.

1st TEST		2nd TEST		Final Test	
takes	points	takes	points	takes	points
6	10	6	10	6	10
5	8	5	8	5	5
4	6	4	5	<5	0
3	4	<4	0		
<3	0				

ALL TESTS: Possible score, 3 x 10 = 30 points.





APPENDIX H: Raw scores of cricket skills obtained through subjective and objective evaluations and used to test for validity (n = 155).

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
1	52	52,5	58	50	71	62,5	57,5	55
2	52	50	48	50	72,5	57,5	60	53
3	56	52,5	58	52,5	68	57,5	66	55
4	38	40	44	45	75	52,5	66	46
5	50	42,5	50	45	67,5	42,5	58	44
6	54	57,5	70	67,5	82,5	57,5	68	61
7	66	57,5	52	50	76	62,5	55	57
8	56	52,5	52	50	63	57,5	63	53
9	54	52,5	52	52,5	68	57,5	65	54
10	48	50	62	55	77,5	62,5	67,5	56
11	48	50	58	60	71	57,5	42,5	56
12	48	50	58	55	67,5	57,5	67,5	54
13	68	67,5	76	70	78	75	60	70
14	74	70	70	70	67,5	65	57,5	68
15	74	70	66	60	80	70	48	66
16	76	50	50	50	75	70	51	56
17	42	45	28	30	75	70	56	48
18	66	65	62	65	65	65	42,5	65
19	64	50	42	45	75	55	46	50
20	70	55	50	55	73	65	66	58
21	64	60	44	60	67,5	65	53	61
22	64	60	36	40	78	60	57,5	53

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
23	80	75	48	60	85	75	52,5	70
24	54	55	58	55	77,5	55	47,5	55
25	60	60	62	52,5	68	57,5	61	57
26	54	50	62	60	72,5	57,5	61	56
27	84	80	72	80	81	82,5	77,5	81
28	84	67,5	46	50	80	77,5	72,5	65
29	76	75	68	60	86	77,5	73	71
30	76	60	72	70	78	55	62,5	61
31	80	65	74	67,5	77,5	57,5	77,5	63
32	68	65	62	65	55	60	62,5	63
33	66	55	68	65	76	57,5	65	59
34	74	60	58	55	72,5	57,5	66	57
35	80	67,5	46	40	80	72,5	70	60
36	72	62,5	66	67,5	72,5	72,5	65	68
37	80	70	56	55	77,5	67,5	60	64
38	74	55	62	60	71	70	77,5	61
39	72	62,5	62	52,5	66	55	62,5	56
40	76	52,5	60	60	76	60	70	58
41	76	52,5	50	47,5	67,5	52,5	60	50
42	72	72,5	76	75	73	67,5	72,5	71
43	80	72,5	62	62,5	80	67,5	65	68
44	76	62,5	56	50	78	67,5	66	60
45	80	57,5	48	50	77,5	70	70	59

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
46	68	62,5	60	62,5	71	65	70	63
47	78	62,5	76	50	83	70	62,5	60
48	74	57,5	54	57,5	81	62,5	63	59
49	66	47,5	46	45	68	62,5	68	51
50	66	67,5	66	77,5	80	72,5	52,5	73
51	72	67,5	64	57,5	85	77,5	61	68
52	62	52,5	70	77,5	68	47,5	60	59
53	52	42,5	52	50	61	52,5	55	48
54	52	42,5	46	47,5	73	47,5	46	45
55	60	57,5	48	45	75	47,5	50	50
56	52	47,5	40	42,5	65	42,5	48	44
57	52	50	68	72,5	70	57,5	57,5	60
58	68	65	64	72,5	66	65	51	67
59	82	67,5	58	60	66	65	48	64
60	82	72,5	44	65	65	67,5	32,5	68
61	84	62,5	48	57,5	73	62,5	43	61
62	70	65	62	75	67,5	77,5	53	72
63	72	77,5	48	62,5	81	72,5	55	71
64	70	65	48	60	63	65	62,5	63
65	50	60	62	60	75	62,5	42,5	61
66	64	62,5	64	65	73	67,5	47,5	65
67	74	65	66	67,5	65	70	52,5	67
68	72	72,5	64	70	67,5	72,5	61	72

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
69	62	62,5	56	67,5	72,5	70	57,5	67
70	68	75	70	75	75	75	61	75
71	72	62,5	72	62,5	63	62,5	65	63
72	48	47,5	52	47,5	56	45	40	47
73	54	55	42	47,5	55	47,5	42,5	50
74	64	70	46	55	67,5	75	68	67
75	64	57,5	32	47,5	66	50	26	52
76	38	45	52	55	66	47,5	23	49
77	38	52,5	44	47,5	53	50	28	50
78	66	77,5	86	72,5	72,5	80	53	77
79	62	70	34	30	50	60	53	58
80	62	70	60	70	57,5	67,5	45	69
81	56	62,5	60	62,5	67,5	62,5	41	63
82	52	60	66	55	58	60	45	58
83	64	47,5	44	45	66	52,5	46	48
84	46	40	44	42,5	61	40	25	41
85	46	50	38	47,5	61	52,5	33	50
86	50	50	52	50	63	57,5	50	52
87	64	47,5	56	57,5	68	57,5	61	54
88	60	57,5	62	62,5	77,5	62,5	46	61
89	66	65	66	62,5	78	62,5	60	63
90	76	67,5	58	55	78	72,5	63	65
91	64	67,5	68	70	80	72,5	63	70

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
92	66	52,5	46	50	71	52,5	53	52
93	60	57,5	82	52,5	71	52,5	51	54
94	68	55	48	47,5	78	57,5	52,5	53
95	56	52,5	56	47,5	77,5	57,5	60	53
96	68	62,5	54	55	77,5	62,5	55	60
97	60	57,5	48	45	73	60	47,5	54
98	54	55	70	67,5	70	65	56	63
99	76	67,5	46	50	68	60	50	59
100	68	57,5	48	50	73	62,5	57,5	57
101	72	65	58	50	67,5	60	52,5	58
102	56	55	60	55	72,5	57,5	55	56
103	50	52,5	40	42,5	70	55	50	55
104	72	60	80	65	83	60	50	62
105	66	55	50	50	71	50	56	52
106	70	65	68	55	71	60	55	60
107	48	52,5	44	50	76	60	47,5	54
108	66	65	54	60	72,5	62,5	47,5	63
109	64	55	56	55	68	60	36	57
110	72	65	58	50	73	65	51	60
111	50	55	56	55	71	65	48	58
112	46	50	56	55	58	55	42,5	53
113	52	50	68	60	67,5	55	55	55
114	44	55	66	65	67,5	55	38	58

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
115	52	60	54	60	67,5	70	51	63
116	48	50	62	60	71	65	40	58
117	58	77,3	52	52,5	83	70	55	67
118	48	62,5	36	35	77,5	75	52,5	57
119	48	62,5	56	47,5	46	40	33	50
120	54	72,5	78	80	77,5	75	56	76
121	50	55	48	47,5	77,5	65	46	56
122	42	52,5	50	50	67,5	65	47,5	56
123	52	55	54	57,5	62,5	60	57,5	57
124	50	50	68	65	68	65	48	60
125	44	50	60	47,5	81	60	57,5	52
126	38	50	74	70	86	70	48	63
127	40	45	56	50	67,5	55	57,5	50
128	50	75	50	50	65	65	62,5	63
129	50	60	54	57,5	80	65	52,5	61
130	68	77,5	60	60	68	70	73	69
131	58	62,5	76	75	76	65	55	67
132	50	50	56	57,5	82,5	55	57,5	54
133	40	50	44	50	60	55	50	51
134	40	42,5	52	47,5	73	45	37,5	45
135	44	55	62	60	71	60	48	58
136	50	47,5	52	47,5	61	45	53	47
137	44	40	50	47,5	72,5	45	47,5	44

Subjects	Batting		Bowling		Fielding		General Ability	
	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.	Obj.	Subj.
138	58	55	64	55	71	50	61	53
139	50	50	58	57,5	68	70	52,5	59
140	50	52,5	46	45	66	67,5	43	55
141	48	52,5	64	65	67,5	77,5	43	65
142	68	67,5	64	47,5	72,5	60	43	58
143	44	50	52	47,5	72,5	62,5	47,5	53
144	50	50	74	77,5	71	72,5	52,5	67
145	58	62,5	72	62,5	57,5	67,5	42	64
146	56	55	50	47,5	71	62,5	45	55
147	34	42,5	48	47,5	63	47,5	47,5	46
148	24	37,5	34	35	53	52,5	22	42
149	44	37,5	32	37,5	48	50	26	42
150	46	50	60	47,5	75	72,5	52,5	57
151	34	35	34	35	63	57,5	38	42
152	30	37,5	44	42,5	68	52,5	35	44
153	50	57,5	62	62,5	62,5	52,5	41	58
154	54	67,5	78	72,5	73	72,5	45	71
155	40	45	58	55	66	47,5	45	49
$\bar{X}$	59	57,6	57	56,1	70,8	61,7	53,5	58,3
SD	12,9	9,7	11,2	10,3	7,7	8,9	11,2	8,0

APPENDIX I: Raw scores of cricket skills tests obtained by inexperienced and then experienced testers and used to test for objectivity (n = 21).

Subjects	Batting		Bowling		Fielding		General Ability	
	Inexp T.	Exp T.	Inexp T.	Exp T.	Inexp T.	Exp T.	Inexp T.	Exp T.
156	54	54	60	62	62,5	70	48	41
157	56	60	50	48	81	82,5	50	58
158	54	58	64	62	66	76	58	55
159	50	58	34	46	72,5	73	51	53
160	78	70	62	66	88	83	68	62,5
161	64	62	64	68	91	77,5	66	62,5
162	62	54	46	52	71	72,5	43	50
163	64	70	74	58	70	82,5	62,5	58
164	54	54	60	56	78	81	65	58
165	70	76	64	66	72,5	77,5	61	58
166	38	52	34	44	70	68	63	60
167	72	72	58	66	80	78	48	55
168	36	48	64	58	72,5	70	65	56
169	38	34	42	44	75	75	56	53
170	66	58	56	50	82,5	78	60	61
171	62	70	52	54	81	78	55	57,5
172	48	48	54	74	72,5	68	51	52,5
173	62	62	56	48	72,5	67,5	43	48
174	50	58	62	56	68	68	47,5	50
175	36	42	56	60	77,5	75	57,5	57,5
176	70	74	76	98	75	76	58	61
$\bar{X}$	56	59	57	59	75,4	75,2	55,8	55,7
SD	12,37	10,83	10,96	12,31	6,93	5,14	7,78	5,37

APPENDIX J: Raw scores of cricket skills tests obtained by experienced and then inexperienced testers and used to test for objectivity (n = 23).

Subjects	Batting		Bowling		Fielding		General Ability	
	Exp T.	Inexp T.	Exp T.	Inexp T.	Exp T.	Inexp T.	Exp T . .	Inexp T.
1	52	66	58	62	71	76	57,5	61
2	52	72	48	62	72,5	73	60	61
3	56	64	56	56	68	72,5	66	62,5
4	38	50	44	54	75	78	66	65
5	50	54	50	54	67,5	78	58	61
6	54	68	70	64	82,5	78	68	63
7	66	66	52	56	76	77,5	55	42,5
8	56	62	52	54	63	76	63	51
9	54	68	52	56	68	78	65	63
10	48	54	62	68	77,5	68	67,5	66
11	48	60	58	60	71	71	42,5	42,5
12	48	70	58	64	67,5	77,5	67,5	65
13	68	72	76	80	78	75	60	65
14	74	78	70	72	67,5	73	57,5	61
15	74	78	66	62	80	82,5	48	56
16	76	54	50	52	75	75	51	52,5
17	42	48	28	34	75	76	56	62,5
18	66	62	62	64	65	80	42,5	56
19	64	50	42	32	75	75	46	52,5
20	70	74	50	50	73	77,5	66	62,5
21	64	68	44	46	67,5	75	53	60
22	64	70	36	46	78	78	57,5	47,5
23	80	82	48	46	85	85	52,5	66
$\bar{X}$	59	65	54	56	73,1	76,4	57,0	58,7
SD	11,47	9,61	11,29	11,11	5,62	3,65	7,71	7,03

APPENDIX K: Raw scores of cricket skills tests obtained by repeated testing and used to test for reliability (n = 23).

Subjects	Test No.	Batting	Bowling	Fielding	General Ability
177	1	74	50	80	57,5
	2	72	46	82,5	61
	3	72	50	85	61
	4	72	50	83	63
	5	72	52	82,5	62,5
178	1	72	68	66	53
	2	76	62	65	50
	3	86	58	76	55
	4	80	64	77,5	65
	5	78	64	72,5	63
179	1	78	42	81	66
	2	74	62	83	61
	3	78	52	91	66
	4	74	64	85	67,5
	5	74	64	87,5	63
180	1	60	42	66	55
	2	68	48	68	55
	3	68	52	68	66
	4	68	52	72,5	60
	5	72	48	77,5	60

Subjects	Test No.	Batting	Bowling	Fielding	General Ability
181	1	56	38	72,5	57,5
	2	62	56	76	61
	3	62	44	72,5	65
	4	68	52	72,5	58
	5	68	50	72,5	57,5
182	1	44	56	77,5	48
	2	64	56	76	50
	3	62	56	73	60
	4	68	64	72,5	57,5
	5	66	64	78	58
183	1	70	56	63	55
	2	84	60	68	55
	3	84	58	81	56
	4	80	62	82,5	45
	5	80	60	75	52,5
184	1	70	44	63	66
	2	74	52	71	61
	3	74	50	68	62,5
	4	76	48	70	67,5
	5	76	48	80	65

Subjects	Test No.	Batting	Bowling	Fielding	General Ability
185	1	56	64	67,5	61
	2	68	58	66	61
	3	72	72	62,5	68
	4	72	74	67,5	57,5
	5	68	74	67,5	61
186	1	84	40	78	57,5
	2	84	38	77,5	57,5
	3	72	52	83	57,5
	4	82	40	86	61
	5	84	40	83	57,5
187	1	68	52	75	61
	2	68	60	75	57,5
	3	70	60	80	62,5
	4	68	56	80	56
	5	64	50	85	62,5
188	1	76	74	75	58
	2	62	72	75	55
	3	78	76	78	63
	4	78	78	75	63
	5	80	78	75	63

Subjects	Test No.	Batting	Bowling	Fielding	General Ability
189	1	74	74	73	58
	2	74	80	87,5	61
	3	70	80	82,5	62,5
	4	78	76	78	63
	5	78	78	78	63
190	1	80	50	67,5	53
	2	82	46	65	50
	3	68	46	76	51
	4	72	44	75	52,5
	5	72	44	72,5	53
191	1	62	64	68	50
	2	74	68	66	56
	3	70	64	73	53
	4	70	56	71	51
	5	70	56	67,5	56
192	1	64	46	68	63
	2	60	46	75	62,5
	3	64	52	68	65
	4	64	54	70	60
	5	66	50	70	60

Subjects	Test No.	Batting	Bowling	Fielding	General Ability
193	1	80	78	78	61
	2	72	78	80	62,5
	3	78	78	83	63
	4	70	72	78	65
	5	72	70	81	63
194	1	50	52	63	58
	2	46	64	71	58
	3	52	64	77,5	60
	4	60	66	80	68
	5	60	68	73	58
195	1	48	62	78	51
	2	76	64	75	45
	3	76	62	73	51
	4	72	56	75	56
	5	70	50	70	56
196	1	84	72	82,5	68
	2	74	66	87,5	62,5
	3	82	64	83	67,5
	4	78	64	80	67,5
	5	76	70	77,5	66

Subjects	Test No.	Batting	Bowling	Fielding	General Ability
197	1	70	48	72,5	43
	2	74	54	67,5	50
	3	68	56	72,5	55
	4	76	66	76	55
	5	74	54	72,5	58
198	1	82	80	68	66
	2	84	82	72,5	62,5
	3	80	80	72,5	65
	4	82	78	88	67,5
	5	82	78	81	68
199	1	68	74	73	67,5
	2	74	82	82,5	71
	3	66	76	83	70
	4	78	76	85	70
	5	80	72	83	71
$\overline{X}$	1	68	58	72,1	58,1
	2	72	61	74,1	57,8
	3	72	61	76,7	61,2
	4	73	61	77,5	60,9
	5	73	60	76,8	60,8
SD	1	11,60	13,34	6,13	6,57
	2	8,84	12,28	7,10	5,95
	3	7,95	11,20	6,75	5,51
	4	5,83	11,09	5,65	6,41
	5	6,17	11,84	5,58	4,47