THE EXERCISE INTENSITY OF MENTALLY RETARDED ADULTS AS A FUNCTION OF AN AEROBIC FITNESS PROGRAM

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Abstract

The objectives of this study were: (1) to compare the exercise intensity elicited by an exercise program with that by a cardiovascular fitness test, and (2) to evaluate the effectiveness of a cardiovascular fitness program with six moderately to severely mentally retarded adult males. The handicapped males participated in an exercise program which consisted of 30 training sessions, approximately 30 minutes in length, held three times per week. After collecting baseline data on the Leger and Lambert Shuttle Run Test, a program emphasizing cardiovascular endurance activities was conducted. The participants were assessed weekly for predicted maximum oxygen uptake on the Leger and Lambert test. Their heart rates were monitored with a Sport Tester on four occasions during the actual exercise program and on seven occasions while performing the Leger and Lambert test.

Heart rate values were collected on only five out of the six males since one of them refused to wear the Sport Tester. The data from the exercise program indicated that only one out of the five mentally retarded participants was performing near a recommended exercise intensity that would elicit a training effect according to the standards of The American College of Sports Medicine. Performance on the Shuttle Run Test indicated that the participants were not achieving their age-predicted maximum heart rate. Because a maximum heart

rate was not elicited, the comparison of exercise intensity by a training program with that by a cardiovascular fitness test was not possible.

In evaluating the exercise program, the Shuttle Run Test results were examined. There was an improvement in running time from 2 minutes, 22 seconds during the baseline period to 3 minutes, 43 seconds during the final portion of the program. These times represent the average of the four trials during pre- and post-program periods.

In summary, the results from the investigation indicated that: (1) monitoring heart rate responses during a physical exercise program is an effective means to demonstrate exercise intensity, and (2) a physical exercise program with emphasis on cardiovascular endurance activities resulted in improved aerobic fitness.

Resume

Les objectifs de cette étude étaient: (1) de comparer l'intensité d'un exercice mis à jour par un programme d'exercices avec celui provoqué par une épreuve cardiovasculaire, et (2) d'évaluer l'efficacité d'un programme cardiovasculaire suivi par six hommes (adultes) gravement et modérément atteints de déficience mentale. Ces handicapés ont participé a un programme d'exercices réparti en trente séances d'entrainement, d'une durée de 30 minutes chacune et à raison de trois fois par semaine. Après avoir enregistré les données de base avec "Leger and Lambert Shuttle Run Test" un programme accentuant les activités d'endurance cardiovasculaire était amorcé. Chaque semaine une évaluation de la consummation d'oxygène d'après le test "Leger and Lambert" était faite auprès des participants. Leurs battements de coeur étaint contrôlés par un "Sport Tester" quatre fois durant le programme d'exercices et sept fois pendent le test "Leger and Lambert.

Les battements de coeur ont été enregistrés sur seulement cinq des six hommes; un homme a refusé de partir le "Sport Tester". Les données du programme d'exercices ont démontré que seulement un des cinq déficients mentaux travaillait avec énergie laquelle provoquerait un effet d'entrainement établi d'après les standards de "American College of Sports Medicine". D'après les résultats du "Shuttle Run Test", on

s'est aperçu que les battements de coeur des participants n'étaient pas au maximum. Pour cette raison, nous ne pouvons pas comparer l'intensité d'exercices entre celle du programme d'entrainement et celle de l'épreuve cardiovasculaire.

Les résultats du "Shuttle Run Test" ont été utilisés dans l'évaluation du programme d'exercices. Il y avait une amélioration dans le temps de course de 2 minutes et 22 secondes à 3 minutes et 43 secondes pendant la dernière partie du programme. Ces lapses de temps représentent la moyenne de quatre essais enregistrés avant et après les periodes du programme.

En résumé, les résultats nous demontrent (1) une facon efficace de montrer l'intensité d'exercice et l'enregistrement des battements de coeur pendant un programme d'exercice et (2) un programme d'exercices qui accentue les activités d'endurance cardiovasculaire avec comme résultat une amélioration dans le conditionnement physique.

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CHAPTER I

INTRODUCTION

Physical fitness is the ability to carry out daily activities with vigor and alertness, without excessive fatigue, and having sufficient energy to enjoy leisure time activities and to meet unanticipated emergencies (Barton, 1982; Shephard, 1977, p.5). Physical fitness is important for health related reasons such as (1) improved circulation and respiration (2) reduced risk of heart disease (3) improved fat metabolism (4) decreased body weight and (5) strengthened bones, ligaments and tendons (Sharkey, 1984, p.3). Mental health benefits, such as a decrease in tension and stress, or enhanced self-concept and body image have also been proposed (Sharkey, 1984, p.3). Finally, vocational needs (Shephard, 1977, pp.231-233; Sherrill, 1981, p.167), as well as the pursuit of constructive leisure may be positively associated with physical fitness. In sum, it is generally believed by health professionals that fitness augments the quality of one's life.

Physical fitness is important for everyone, including adults who have mental retardation. Since mentally retarded persons may not be functioning at a level which is sufficient for them to carry out jobs with a high intellectual component, a satisfactory level of physical fitness is often necessary to

survive in a vocational situation (Barton, 1982; Coleman, Ayoub & Friedrich, 1976). The mentally retarded, therefore, must develop a level of physical fitness which will allow them to be as self-sufficient as possible in performing tasks requiring physical labor.

Research indicates that adults who have mental retardation are particularly in need of physical fitness education because they usually have very low levels of fitness (Coleman et al., 1976; Nordgren, 1970, 1971; Reid, Montgomery & Seidl, 1985). The low fitness levels are by no means an invariant quality of mental retardation. This statement is supported by studies that demonstrate improvements in physical fitness when systematic programs of exercise are introduced (e.g. Barton, 1982; Beasley, 1982; Halle, Silverman & Regan, 1983; Montgomery & Reid, 1984,1985; Schurrer, Weltman & Brammel, 1985; Tomporowski & Ellis, 1984; Tomporowski & Jameson, 1985).

The certainty that some inherent characteristic of mental retardation necessarily lowers fitness levels is a hasty conclusion. Six factors seem to contribute to the low fitness levels.

1. Mentally retarded male and female adults tend to display mean body weights in excess of their ideal weights (Emery, Watson, Watson, Tompson & Biderman, 1985; Reid, Montgomery & Seidl, 1985). Often obesity is a prevalent condition (Burkart, Fox & Rotatori, 1985; Fox & Rotatori,

1982). It is likely that an interrelationship exists between activity level and obesity. A low level of fitness may be a cause or a result of an obese condition. An individual may lower his or her activity level without correspondingly reducing caloric intake, which in turn may contribute to an overweight condition. Another likelihood involves an already overweight individual who reduces his or her energy expenditure. This contributes to a decrease in physical fitness, which then leads to reduced energy expenditure and further weight gain (Burkart et al., 1985).

2. The leisure activity of mentally retarded persons is generally passive (Cheseldine & Jeffree, 1981; Reiter & Levi, 1981). Severely retarded persons, if left to themselves, generally do not engage in deliberate activity or play (Grosse, 1981; Sherrill, 1981,p.447).

3. The mentally retarded do not have the same opportunities to participate in physical activity as nonretarded adults (Bauer, 1981; Broadhead, 1981; Speakman, 1977).

4. The improvement and maintenance of physical fitness is difficult to achieve with these individuals because they are not motivated by weight loss, increased energy or other intrinsic benefits that may encourage nonretarded persons to maintain fitness programs over time (Moon & Renzaglia, 1982). The mentally retarded require greater incentive to perform well (Caouette & Reid, 1985; Halle et al., 1983; Montgomery &

Reid, 1985; Speakman, 1977; Wagner, 1967).

5. Gottlieb (1982) suggested that the performance of handicapped persons will deteriorate when it occurs under the threat of evaluation. Thus, the validity of physical fitness estimates may be disputed since performance may have been effected by this evaluative component. The mentally retarded persons' fitness performance is likely underestimated in evaluative situation.

6. Many fitness items are too intellectually complex to bring out maximal performance in only a few trials (Speakman, 1977). The mentally retarded have great intra-individual variability in their performance on fitness items (Montgomery & Reid, 1985). With a greater number of trials, the participants would have the opportunity to learn the intellectual components of the item and thus perform better and more consistently.

Studies that have demonstrated the benefits of physical fitness programs for mentally retarded adults have considered some of these contributing factors to the low fitness levels. They have recorded the participants' body weights (Coleman & Whitman, 1984; Schurrer et al., 1985), considered their motivational levels (Barton, 1982; Beasley, 1982; Caouette & Reid, 1985; Coleman & Whitman, 1984; Halle et al., 1983), viewed their present baseline activity levels (Beasley, 1982) and considered the complexity of the task items (Fait & Kupferer, 1956; Koh, 1986; Tomporowski & Ellis, 1985;

Tomporowski & Jameson, 1985). However, the threat from evaluation does not appear to have been taken into consideration.

The complexity of task items and the evaluative threat are two major factors that may affect the test performance of retarded individuals. The evaluative component seems to be a particular concern because it directly influence the interpretation of the effectiveness of the exercise program. What is needed, therefore, is an unobtrusive means of examining the physiological responses of mentally retarded individuals. This would provide a more objective determination and indication of the level of physical demands at which the retarded adults are working.

With activities that are isotonic in nature and that utilize large muscle groups, there is usually a linear relationship between heart rate and oxygen consumption (Davis & Conventino, 1975). Therefore, exercise intensity expressed in terms of percent maximal oxygen uptake can be estimated using the heart rate (Davis & Conventino, 1975). Hence, monitoring the heart rate of the participants during the actual program can act as an indirect measure of oxygen uptake and therefore function as an unobtrusive measure in the documentation of their cardiovascular functioning.

Auditing the physiological responses of mentally retarded individuals before, during and after physical activity (Broadhead, 1986) would objectively demonstrate the physical

condition of this group. Heart rate responses, of mentally retarded participants in fitness research, have been monitored primarily before and after physical exercise, and during cardiovascular testing (e.g. Caouette & Reid, 1985; Coleman et al., 1976; Coleman & Whitman, 1984; DePauw, Hiles, Mowatt & Goc-Kamp, 1985; Koh, 1986; Montgomery & Reid, 1985; Schurrer et al., 1985; Tomporowski & Ellis, 1984). Only three studies have recorded the heart rate response of mentally retarded persons during physical exercise (Kamimura & Kusano, 1981; Maksud & Hamilton, 1974; Mulholland & McNeil, 1985), but none have traced the course of the heart rate during a training program and during subsequent fitness testing across sessions. The present investigation will supplement the existing information on the heart rate responses of mentally retarded individuals during physical exercise. It will evaluate the effects of the aerobic training program on the participants' fitness, and compare the heart rates elicited while training with those elicited during the fitness testing.

1.1 Statement of the Problem

The purpose of the present investigation was to observe the effects of an endurance exercise program on the physical fitness of young adult mentally retarded males. The aim was also to compare the the heart rates obtained during an endurance test with the heart rates obtained during an actual cardiovascular fitness program.

1.2 Hypotheses

1.2.1 Aerobic activities during a ten week cardiovascular fitness program will elicit heart rate intensity of 60 per cent of maximum heart rate reserve.

1.2.2 Participants will increase their physical fitness as a function of a 30 session cardiovascular endurance program.

1.2.3 The participants will demonstrate a higher level of exercise intensity during the training program than during the testing session.

1.3 Delimitations

1.3.1 Only male participants were used in the study.

1.3.2 The IQ range of the participants was 27 to 46.

1.3.3 The participants' ages ranged from 19 to 22 years.

1.4 Limitations

1.4.1 The motivational level of mentally retarded persons is often low. Intrinsic motivation is frequently absent (Speakman, 1977; Wagner, 1967). Though ample effort was made to elicit optimal performance from all participants through verbal reinforcement and task structure, it cannot be assumed that efforts were maximal or uniform across participants.

1.4.2 The protocol of the Leger Shuttle Run Test requires the participants to follow a cadence in order for the test to effectively predict maximal oxygen uptake. It has been suggested that with training and practice, mentally retarded persons will learn how to pace themselves (Tomporowski & Jameson, 1985). In the present investigation the participants were systematically taught the pacing technique. However, given the relatively low IQ levels of the participants, one cannot be certain that the concept of pacing was completely understood.

1.4.3 The various fitness studies employing mentally retarded individuals as participants have had programs that ranged from

eight weeks to seven months in duration, and with three to five days in frequency (e.g. Barton, 1982; Beasley, 1982; Halle et al., 1983; Montgomery & Reid, 1985; Schurrer et al., 1985; Tomporowski & Ellis, 1984; Tomporowski & Jameson, 1985). The present investigation adopted program frequency and duration relative to the previous fitness studies. The experimental treatment consisted of a physical activity program of 30 minute sessions, thrice weekly, for a period of ten weeks.

1.5 Definitions

Mental Retardation: is significantly subaverage general intellectual functioning (e.g. approximate IQ 70 or below) existing concurrently with deficits in adaptive behaviour (e.g. the degree with which individuals meet the standards of personal independence and social responsibility expected for their age and cultural group) and which is manifested during the developmental period (e.g. birth to 18 years) (Grossman, 1983).

Moderate Mental Retardation: is a level of mental retardation in which the IQ score is in a range of 35 to 55 (Grossman, 1983).

Severe Mental Retardation: is a level of mental retardation

in which the IQ score is in a range of 20 to 35 (Grossman, 1983).

Cardiovascular Endurance: is the ability of the respiratory and circulatory system to provide the working muscles with oxygen (Sharkey, 1984, Chapt. 1 & 2; Shephard, 1977, Chapt.1).

Maximal Oxygen Uptake (VO2 max): is a quantitative measure which provides a statement of an individual's capacity for aerobic energy transfer (de Vries, 1966, pp. 204-205). Predicted estimates of this measure will be converted from the running times on the Leger Lambert Test.

Heart Rate (HR): is the number of contractions of the heart per minute (Vander,Sherman, & Luciano, 1980, p.653).

Maximum Heart Rate: is the greatest number of contractions of the heart per minute (PARTICIpaction, Fitness Canada).

Maximum Heart Rate Reserve: is the percent difference between resting and maximum heart rate added to the resting heart rate (American College of Sports Medicine, 1980).

Heart Rate Intensity: is calculated utilizing Karvonen's method which corrects the exercise heart rate for the resting heart rate (Karvonen, Kentala & Mustalo, 1957).

$$\text{Percent Intensity} = \frac{\text{exercise HR} - \text{resting HR}}{\text{maximum HR} - \text{resting HR}} \times 100$$

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of the investigation was to observe the effects of an endurance program on the physical fitness of young adult mentally retarded males. It was also the purpose of the investigation to compare the heart rates obtained during an endurance test with the heart rates obtained during an actual program. In this chapter, the literature relevant to the investigation will be reviewed in the following sections: (2.1) mental retardation, (2.2) motivation and the mentally retarded individual, (2.3) motor proficiency and mental retardation, (2.4) physical fitness and mental retardation and (2.5) summary of the review of the literature.

2.1 Mental Retardation

Mental retardation is a human condition. It is not an illness nor a disease, nor is it curable. The American Association on Mental Deficiency (Grossman, 1983) defines mental retardation to be "significant subaverage general intellectual functioning resulting in or associated with concurrent impairments in adaptive behavior and manifested during the developmental period." Significantly subaverage

general intellectual functioning refers to an IQ of 70 or below on the standardized measures of intelligence (Grossman, 1983). Impairments in adaptive behavior suggest that persons labelled mentally retarded need support to achieve expected standards of personal independence and social responsibility (Grossman, 1983). That this condition is present during the developmental period means that the subaverage general intellectual functioning and the impairments in adaptive behavior are apparent between conception and the eighteenth birthday (Grossman, 1983).

The mentally retarded population is a heterogeneous group ranging from those who are totally dependent to those who are nearly independent. Levels of retardation are classified with respect to the severity of the disability. According to one of the several methods of classification, the four degrees of mental retardation are: mild, moderate, severe and profound (Grossman, 1983; The Montreal Association for the Mentally Retarded, 1983). Mild mental retardation is associated with an IQ range of 50-55 to approximately 70 (Grossman, 1983). This group can attain independence in the community with minimal support and can master basic academic skills (The Montreal Association for the Mentally Retarded, 1983). Moderate mental retardation is associated with an IQ range of 35-40 to 50-55 (Grossman, 1983). The moderately retarded can learn self-help, communication, social and occupational skills, but their academic skills are limited (The Montreal

Association for the Mentally Retarded, 1983). Severe mental retardation is associated with an IQ range of 20-25 to 35 (Grossman, 1983). Personal self-care and communication skills can be achieved by this group. To attain some level of independence, more intensive support is needed (The Montreal Association for the Mentally Retarded, 1983). Profound mental retardation is associated with an IQ range below 20 (Grossman, 1983). The profoundly retarded can achieve simple self-help skills and often exhibit other handicaps. The most intensive level of support to enable life in the community is obligatory for this level of retardation (The Montreal Association for the Mentally Retarded, 1983).

2.2 Motivation and the Mentally Retarded Individual

Motivation refers to the causes and influences of initiation, perseverence and intensity of behavior (Magill, 1985, p.409). Why do mentally retarded people initiate a form of behavior? Why do mentally retarded people persevere to behave in a certain way after they have begun a behavior? What produces the variations in the intensity of performance of an individual who has mental retardation?

Interest in the motivation of mentally retarded individuals has ensued mainly because repeated motivational deficiencies have been observed among these individuals (Zigler, 1969). Often the low motivational level of retarded

persons has been reported in the domain of physical activity. Generally the leisure activity of retarded adults is passive (Cheseldine & Jeffree, 1981; Grosse, 1981; Reiter & Levi, 1981). A study on activity levels during free play identified Down's Syndrome children as hypoactive, in that they move less often (Linford, Jeanrenaud, Karlson, Witt & Linford, 1971 as cited by Li, 1981). Also, the mentally retarded population require greater incentive to perform well in physical fitness activities (Caouette & Reid, 1985; Halle, et al., 1983; Montgomery & Reid, 1985; Wagner, 1967). Furthermore the maintenance of physical fitness is difficult to achieve with these individuals because they are not motivated by weight loss, increased energy, or other possible intrinsic benefits that may encourage nonretarded persons to maintain fitness programs over time (Moon & Renzaglia, 1982).

2.2.1 Motivational Orientation

Motivational orientation refers to a personality trait which is characterized in terms of sources of incentives that are effective in motivating that person's behavior (Haywood & Switzky, 1985). Cromwell (1963, p.47) suggests that the experiences of mentally retarded persons have an impact on their personality. Failure and frustration are encountered more frequently and with greater intensity by retarded persons than by nonretarded persons (Cromwell, 1963, p.87). Hence

characteristic personality traits that distinguish mentally retarded individuals from nonretarded could result from consequences of these experiences (MacMillan, 1977, p.383).

Retarded persons have needs and goals that motivate them to behave in the way they do (MacMillan, 1977, p.402). The need for social acceptance stems from social deprivation associated with institutionalized mentally retarded persons (Zigler, 1966). At early ages, retarded persons learn that the effort they expend on difficult tasks does not lead to success, therefore they perceive themselves to be incompetent (Schwethelem & Mahoney, 1986). Hence they need to feel more competent at what they do. Mentally retarded persons try to satisfy these needs of social acceptance and competence by behaving in characteristic ways.

2.2.2 Positive and Negative Reaction Tendencies

Institutionalized retarded persons tend to have been deprived of adult contact and approval, therefore may have increased motivation to secure contact and acceptance. They often have a positive reaction towards others (Zigler, 1966). This positive reaction is manifested in their increased desire for social reinforcement. The tendency to positively interact with and to seek reinforcement from others who approve corresponds with the mentally retarded person's actively seeking attention and affection (Balla & Zigler, 1979).

Concurrently the institutionalized retarded individual tends to react negatively towards others, a behavior which stems from their more frequent unpleasant encounters with adults. Reluctancy and wariness to interact with others typifies the negative reaction mentally retarded people may exhibit (Balla and Zigler, 1979). These tendencies and their relative intensities, appear to be the result of distinct environmental experiences and, as Zigler (1966) suggests, seem to be open to manipulation and modification.

2.2.3 External Motivational Orientation

Retarded persons seem to have a low expectancy of success and a high expectancy of failure (Balla & Zigler, 1979; Cromwell, 1963; Heitman & Justen, 1980; Siegel, 1979; Zoeller, Mahoney & Weiner, 1983). These expectations have been viewed as an outcome from prevailing confrontations with tasks with which mentally retarded individuals are intellectually ill-equipped to deal (Balla & Zigler, 1979).

Since expectancy influences behavior, the performance of mentally retarded persons should show a qualitative and quantitative decrement in their work relative to their ability. This in turn may reinforce the low expectancy for success (Heber, 1964). The result is a further decrease in performance and further failure and even lower expectancies for success.

People who have mental retardation fail so often that, when subjected to a task, they expect to fail before attempting the task. These expectancies may lead the retarded person to persist far less at tasks that appear to be slightly challenging and to prefer those that can be solved quickly and easily. Therefore task persistance may be a reflection of their inclination to repeat activities that are within their repertoire rather than as a motive to achieve competence (Schwethelem & Mahoney, 1986).

An outcome, whether success or failure, may be seen as largely the consequence of one's own actions or characteristics or as the result of outside forces such as fate, chance, the action of powerful others or situational variables (Lawrence & Winschell, 1974). Attributing the success or failure to external factors is distinctive of one who possesses an external locus of control. The locus of control one exhibits is dependent upon the degree to which one accepts personal responsibility for one's own outcomes (Lawrence & Winschell, 1974).

Individuals who continuously experience failure are prone to exhibiting an external locus of control (Dudley-Marling, Snider & Tarver , 1982). Mentally retarded persons have been reported to display this type of locus more than those of average intelligence (Dudley-Marling,et al., 1982). Because their perceptions of personal control are minimal, they tend to attribute their successes and failures to external factors.

The external locus of control of mentally retarded persons is probably due to their inherent limitations in dealing with life experiences along with artificially devised success provided in special education classes that promote a dependency response (Lawrence & Winschell, 1974). Therefore, their behavior is largely under the control of others and reinforcement is dependent on chance, fate or other external forces. To be influenced by external control results in reward seeking behavior and a dwindling tendency to persist in difficult tasks or to carry on in the face of failure (Lawrence & Winschell, 1974).

Actions are often a reflection of self-perception in relation to one's environment. The external locus of control of mentally retarded individuals will influence their motivational orientation and subsequently their behavior. When the incentive to perform the motor tasks was highly salient and attractive, Caouette and Reid (1985), Montgomery and Reid (1985) and Wagner (1967) found that the retarded persons were further motivated and their was performance enhanced. Studies investigating the acquisition of motor skills (Hannaford, 1971; Smith, 1972) show that the retarded person's performance was facilitated by verbal and tangible incentives.

2.2.4 Outerdirectedness

Mentally retarded persons are more outerdirected in their problem-solving than are nonretarded (Lustman & Zigler, 1982). Outerdirected persons tend to imitate the behavior of others (MacMillan, 1977, p.402; Balla & Zigler, 1979). This trait is typified by the propensity to rely on cues that are emitted by others or that are available in the environment rather than utilizing ones's own cognitive resources (Balla & Zigler, 1979; MacMillan, 1977; Ruble & Boggiano, 1980; Zigler, 1966). Three factors have been described to determining an individual's degree of outerdirectedness (Balla & Zigler, 1979; MacMillan, 1977; Ruble & Boggiano, 1980) : (1) the general level of cognitive development, (2) the history of successes and failures the individual has experienced when employing his or her own cognitive resources and (3) the extent of the individual's attachment to others. The retarded person's outerdirectedness may be due to the high incidence of failure experienced by them. For example, they may fail frequently because of their limited intellectual ability and therefore lose confidence in their own cognitive solutions and look to the behavior of others for guidelines to actions (Lustman & Zigler, 1982). Their high incidence of failure and their positive reaction tendency may lend themselves to generating a style of problem-solving in which outerdirectedness is featured. MacMillan (1977) proposes that

as retarded persons attempt to solve problems using their own cognitive abilities and subsequently learn that they are wrong more often than right, they consequently come to disbelieve their own abilities and outerdirectedness perseveres.

The mentally retarded person's display of needs for social reinforcement, wariness of adults, fear of failure, lower expectancy of success and an outerdirectedness style of problem-solving take precedence over effectance motivation in the retarded person's motive hierarchy (Harter, 1977). While performing a puzzle task, Harter (1977) found that the mentally retarded subjects were more concerned about failure, particularily on the more difficult puzzles and they were more dependent on adult experimenters for feedback, praise or direction than their nonretarded counterparts. They liked and preferred to repeat the easier puzzles as opposed to attempting the more difficult ones. It was suggested that effectance motivation components (e.g. curiosity, variation-seeking, mastery for the sake of competence, and preference for challenging tasks) are lower on the motive hierarchy of mentally retarded individuals.

2.3 Motor Proficiency and Mental Retardation

Proficiency in motor skills is a central aspect of human development. It is important for one's health, social, personal and vocational adjustment (Bruininks, 1974). Motor

proficiency is an example of adaptive behavior which is one of the key elements in the definition of mental retardation.

The literature regarding the motor proficiency of mentally retarded children does not distinguish motor proficiency from physical fitness. Historically, the test components to measure proficiency were often both health-related and motor performance-related (e.g. Francis & Rarick, 1959; Rarick, Widdop & Broadhead, 1970; Wagner, 1967).

Mentally retarded children lag behind children of normal intelligence in the development of motor skills and in their physical fitness (Francis & Rarick, 1959; Rarick et al., 1970). Specifically, Rarick, Widdop and Broadhead (1970) found their 4,235 educable mentally retarded subjects to be approximately two to four years behind their normal peers on most of the performance measures. Wagner (1967) also concluded that there were major differences between the abilities of the educable mentally retarded girls and their nonretarded chronological and mental age peers on measures of motor proficiency. As such it took the retarded girls more trials to reach maximal performance than the other two groups. The Francis and Rarick (1959) results revealed that as the mentally retarded subjects increased in age, the lag in motor skill performance increased. Age changes in motor skill performance seemed to essentially follow the same course as those of their normal peers.

Both Francis and Rarick (1959) and Rarick et al. (1970)

concluded that the retarded childrens' pattern of change according to gender was similar to those noted in normal children. The boys were superior in all skills at all ages.

Programs have been developed to improve retarded children's motor proficiency, specifically PREP (Watkinson & Wall, 1982), I Can (Wessel, 1981), Project ACTIVE (Vodola, 1978) and Special Olympics (Young, 1981). If motor programs are not implemented in childhood, this inadequacy for retarded children to execute motor skills may carryover into adulthood.

While studies with mentally retarded children have emphasized both the motor performance-oriented parameters and the health-oriented fitness components concurrently, for retarded adults the focus has been on the latter. In adulthood, health related fitness should be a main concern because of reduction in functional capacity with age (McArdle, Katch & Katch, 1986, p. 563). Hence the interest in the well being of retarded adults has concentrated on the health-related fitness components of cardiovascular endurance, muscular strength and endurance, flexibility and body composition.

2.4 Physical Fitness and Mental Retardation

The concern of physical fitness for general well-being should not be restricted to nonretarded individuals. Several studies have documented that mentally retarded children

(Francis & Rarick, 1959; Halle et al., 1983; Kamimura & Kusano, 1981; Rarick et al., 1970; Soloman & Pangle, 1967) and adults (Beasley, 1982; Coleman et al., 1976; Nordgren, 1970, 1971; Schurrer et al., 1985) have a lower level of physical fitness than nonretarded persons. However, recent fitness studies are indicating that many mentally retarded individuals are able to perform in and benefit from exercise programs (Barton, 1982; Beasley, 1982; Caouette & Reid, 1985; Halle et al., 1983; Montgomery & Reid, 1984, 1985; Mulholland & McNeil, 1985; Schurrer et al., 1985; Tomporowski & Ellis, 1984; Tomporowski & Jameson, 1985).

The majority of the fitness research with mentally retarded adults has emphasized the cardiovascular fitness of this population. It is in this dimension of physical fitness where mentally retarded individuals seem to be particularly low (Beasley, 1982; Schurrer et al., 1985). Studies have not restricted their investigations only to cardiovascular fitness but have also considered the retarded person's motivation to perform in an aerobic program. Montgomery and Reid (1985) established goal times on performance in a shuttle run test for the participants to achieve. An initial reward was given once the goal was reached three consecutive times. When the initial goal was reached, a subsequent goal and reward were established. It was concluded that a program emphasizing cardiovascular endurance activities and containing positive reinforcers improved the aerobic endurance of mentally

retarded adults. However when a second goal time was established, six of the participants did not reach the goal and actually informed the instructor that they had little interest in striving for the goal. Thus motivation still remained a factor influencing the cardiovascular testing performance of six of the retarded adults.

In another study by Halle et al. (1983) incentives were provided throughout the cardiovascular program. For the daily quarter-mile walk-run, quotas were established and when the group score was reached the group had a popcorn, peanut or doughnut party. The weekly 600 yard field test was accompanied with juice and a snack if there was a decrease in the individual's previous test score. The researchers recognized the importance of using various reinforcers (e.g. parties, toys, stickers, juice and snack and social consequences) in order to capitalize on a novelty effect and to maintain a high level of interest. With motivational systems implemented throughout the program, and not only at testing as per Reid and Montgomery (1985), six out of the nine educable mentally retarded children succeeded in decreasing their time required to cover the 600 yard walk-run.

Recognizing that the motivation to persist at physical activity is a key element for the retarded individual, Caouette and Reid (1985) investigated potential reinforcers that would encourage activity at a task which was likely to improve cardiovascular fitness. The authors focused on

determining the effects of visual and auditory stimulation on a continuous motor task, pedalling a stationary bicycle ergometer. All of the six severely retarded adults increased the level of work output following the initial baseline condition. Over the sessions which followed, with the exception of one adult, all carried on and further enhanced their output. The study revealed that reinforcers may differ amongst severely retarded adults but that heightened participation on a continuous motor task can be achieved.

It remains uncertain whether observed testing scores are entirely due to poor cardiovascular fitness, lack of motivation, per se, or the ineptitude of the retarded participants to perform optimally on the task. The complexity of the task items required to perform the fitness test is a major concern. The movements required may be too difficult for the retarded person to coordinate. Perhaps it is the retarded person's lack of understanding of what behaviour is required on the task items that effects the test score. Fait and Kupferer (1956) supported the notion that fitness items may be too physically complex that retarded children are not able to produce maximal effort. Forty-one educable mentally retarded boys performed two motor tasks, the vertical jump and the squat thrust. The results from the vertical jump were favourable when compared to those of the non-retarded boys, whereas the squat thrust performance was substantially lower than the results of the non-retarded population. The

investigators saw distress and inefficiency in movement of the retarded boys as they progressed toward completing a cycle of the squat thrust and repetitions of it. It was concluded that the differences between the vertical jump and squat thrust were influenced by the physical complexity of movements involved in performing a squat thrust as opposed to differences in fitness abilities.

Seidl (1986) found that the mechanical efficiency of stair stepping retarded female adults was below the efficiency rate of the nonhandicapped for The Canadian Home Fitness Test. The participants encountered more difficulty in maintaining a constant pace and as many as 60 percent of the women could not initially step at the quickest stepping rate of the test. Too much error would result when using regression equations to predict maximal oxygen uptake of retarded adults if they were less efficient than the standard value for stepping.

The mode of exercise and the testing protocol used with retarded participants was investigated in four studies (Koh, 1986; Nordgren, 1971; Reid, Montgomery & Seidl, 1985; Tomporowski & Jameson, 1985). Since its introduction, approximately 80 percent of those who have participated in The Canada Fitness Award-Adapted program were incapable of completing the endurance run (Koh, 1986). This is the reason for Koh (1986)'s determining the effectiveness of a proposed pacing protocol to improve the performance of trainable mentally retarded children and youth on The Canada Fitness

Award-Adapted run. When two age groups were studied, Koh found the systematic pacing protocol to be effective in improving the time taken to complete the run by the 10-12 year old group. The 13-and-older group did not improve their time and subsequently the effectiveness of the protocol was not supported for this group. The investigator proposed that the 13-and-older group's lack of performance improvement was due to the running distance for this group being 800m longer and that the longer distance made it harder for the participants to stay motivated, to plan and keep a reasonable pace.

Nordgren (1971), using cycle ergometry, experienced difficulties determining physical work capacities for retarded participants. Twenty-five of the participants could not carry out the test adequately. The author explained this occurrence to be the result of the inability to follow the required pace, and the inability to complete more than one work load; in addition two participants were unable to cycle satisfactorily, and several admitted to experiencing tiredness and breathlessness which were limiting maximal efforts.

The stepping field test of The Canadian Home Fitness Test was used to determine the cardiovascular fitness levels of 184 trainable and educable mentally retarded adults (Reid et al., 1985). Like Nordgren (1971), it was found by Reid et al (1985) that the retarded participants experienced difficulty in achieving and maintaining the required pace. Forty-five percent of the participants were stopped after an exercise

bout because they had not increased their tempo over the previous three minutes, hence they stopped stepping prior to reaching target heart rates. With the actual stepping rate recordings, the researchers had to interpolate oxygen requirements in order to forecast maximal oxygen uptake from a regression equation.

Tomporowski and Jameson (1985) support previous studies (Koh, 1986; Nordgren, 1971; Reid et al., 1985) advocating that mentally retarded individuals experience difficulty in adhering to predetermined paces. The examination of the exercise behaviour of 19 severely and profoundly retarded adults used three modes of exercise: treadmill running, cycle ergometry and rowing ergometry. Some of the participants were able to maintain a regular cycling or rowing pace even though the intensity of exercise on these apparatus was subject to the participant's own cadence. However, most performed in quick bursts of pedaling or rowing. The training and practice of pacing improved most of the participant's exercise behaviour on the stationary bicycle and rowing machine; none of them, however, performed in a manner that would meet the minimal requisites for amelioration in cardiovascular fitness (American College of Sports Medicine, 1980).

Tomporowski and Ellis (1984) proposed that in order to ensure that mentally retarded persons understand the response requirements of fitness test items, special instruction for

many may be necessary. Pretest preparation could prevent the assessment of retarded individuals who do not comprehend how a test item is to be executed. Lavay, Giese, Bussen and Dart (1987) concur with Tomporowski and Ellis (1984) and emphasize that it is crucial for retarded persons to learn the test item. Sufficient practice sessions should be available in order for the retarded individuals to aquaint and accomodate themselves with the fitness test procedures and apparatus before the actual testing begins.

Pretest preparation was supported by Seidl (1986) who found a 20 percent increase in the number of participants proficient in completing a stair stepping field test with practice over four trials. The author implemented specific teaching techniques such as physical, visual and verbal prompting.

Still another problem posed to testing mentally retarded individuals is a perceived threat to evaluation. Gottlieb (1982) found that academically handicapped children made more errors in oral reading under evaluation conditions than under conditions where evaluation was absent. If the academic performance of handicapped persons deteriorates when it occurs under the threat of evaluation, perhaps this extends into motor performance as well.

Cardiovascular fitness testing of mentally retarded persons is suspect due to the possible factors influencing test performance. The reasons commonly reported which attempt

to explain poor performance by retarded individuals have included the following: (1) lack of motivation; (2) the motor complexity of the task; (3) tasks are not well understood; and (4) a perceived evaluative threat. These factors may effect the validity of physical fitness estimates which are the key to determining the effectiveness of exercise programs.

Numerous investigations have considered the scope of the physical fitness of mentally retarded people. These studies have concerned themselves with performance based information and, by serendipity have identified obstacles to performance such as lack of motivation, task complexity and evaluative threat. Perhaps a way to circumvent some of these obstacles would be to consider non-performance based data, that is, one could determine the exercise intensity that an individual worked at by measuring the changes in heart rate responses monitored during physical activity. It has been established that the extent of the heart rate response to an exercise load can be used as an indicator of the overload that is being placed on the body, in general, and the cardiorespiratory system specifically (Davis & Conventino, 1975).

There is a paucity of literature on the physiological responses of mentally retarded persons to physical exercise (Kamimura & Kusano, 1981; Maksud & Hamilton, 1974; Mulholland & McNeill, 1985). Kamimura and Kusano (1981) measured the physical activity and heart rate level of five children with Down's syndrome. During the seven actions of running,

walking, standing, sitting on a chair, sitting down, and sitting and lying on the floor, the heart rate levels of the Down's children showed little periodic change. Furthermore, the children were very inactive and, in free play, they spent more time simply sitting on the floor.

Maksud and Hamilton (1974), using cycle ergometry, found the heart rates of their 62 educable mentally retarded boys to be lower than values generally reported for young adolescents who are either nonhandicapped or below average intelligence. This suggests that the participants tended to stop cycling before maximal heart rate values could be attained. Explanations offered for relatively low work output included: lack of extensive bicycle experience, motivational deficiency and lack of habitual physical activity.

Mulholland and McNeill (1985) examined the heart rate responses of three profoundly retarded multiply handicapped children to determine the effects of physical activities on their cardiovascular system. The study has merit in that it documents the relationship between the energy requirement of physical activity and heart rate. It suggests that monitoring heart rate provides an objective medium by which gross cardiovascular response can be monitored in the mentally retarded population.

2.5 Summary of the Review of Literature

Mentally retarded persons demonstrate impairments in adaptive behavior. Research on the motor proficiency of retarded children showed that they have been consistently found markedly inferior to nonretarded children on measures of motor ability. This indicates that support to achieve expected standards is greatly needed for this population.

The causes and influences of the initiation, perseverence and intensity of mentally retarded persons' behavior was highlighted in the literature. This populations' need for social reinforcement, display of anxiety towards adults, fear of failure, low expectancies for success and outerdirectedness seem to be central in their motives to behave. Awareness and understanding of retarded persons motivation and drive is important if action and learning are to happen.

The need for retarded persons to participate in physical activity is vital. This group of individuals, in general, is less fit than nonretarded persons. However studies have demonstrated that increases in fitness condition can be achieved with physical education programs.

The observed low fitness levels have not only been attributed to the retarded person's physical capacity, but also to other contributing factors. The studies reviewed suggested that poor fitness performance by retarded individuals can be attributed to: the lack of interest and

motivation, the motor complexity of the task, the lack of understanding the required behaviors to do the task or to a perceived evaluative threat.

If fitness assessment of retarded individuals is to be objective and valid, then the aforementioned obstacles need to be minimized or preferably eliminated. The present investigation was designed to show that testing underestimates fitness performance and to surmount the possible confounding of variables with the actual fitness condition.

CHAPTER III

METHODOLOGY

The purpose of the investigation was to observe the effects of an endurance exercise program on the physical fitness of young adult mentally retarded males. It was also the purpose of the investigation to compare the heart rates during an endurance test with the heart rates obtained during an actual cardiovascular program. The following chapter is subdivided into five sections: (3.1) participants, (3.2) instrumentation, (3.3) procedure, (3.4) design and (3.5) treatment of the data.

3.1 Participants

Six male moderately to severely mentally retarded adults with a mean chronological age of 21 (range: 19-22), and a mean IQ of 35.6 (range: 27-46) participated in a 10 week (30 sessions) cardiovascular endurance training program. All are enrolled in the same class at John F. Kennedy School, Beaconsfield, Quebec.

The participants were not currently involved in a regular cardiovascular conditioning program. They received physical education classes twice a week which consisted of one session in the gymnasium and one session of swimming. Further

description of the six participants involved in the investigation is presented in Table 1. In addition, participant 3 was taking Depakane, a drug to control his epileptic condition. Participant 6 was echolalic in his speech.

3.2 Instrumentation

The following modes of assessment were used to evaluate the effectiveness of the training program. Both the Leger and Lambert Shuttle Run Test and Sport Tester have been used with mentally retarded adults in a fitness study by Montgomery and Reid (1985).

Leger and Lambert Shuttle Run Test Protocol

This test is a series of continuous two minute runs at a predetermined pace. Two lines were positioned 20 metres apart. The participants were instructed to be at each line of the 20 metres when a pre-recorded whistle signal was heard on a tape recorder. Participants were instructed to touch each end line with at least one foot. They were asked to maintain the cadence of the tape recording and not to go faster or slower than the desired rhythm. Every two minutes the cadence became faster, thus increasing the workload. The goal of the test was to complete as many workloads as possible while maintaining the rhythm on the tape. A distance of two metres

Table 1

Description of the Participants

Participant	Age (years)	Etiology	Height (cm)	Weight (kg)	Domicile
1	22	Down's Syndrome	154.9	67.1	family
2	22	Down's Syndrome	156.2	56.9	group home
3	20	Down's Syndrome	161.3	56.9	group home
4	22	unknown	170.2	67.1	family
5	21	Down's Syndrome	149.9	52.9	group home
6	19	unknown	175.3	67.6	group home

from each line was marked on the floor with tape. If the participants were two metres or more behind the cadence of the next whistle, the test was stopped for that participant. The running time of the participants was recorded and then converted into predicted estimates of maximal oxygen uptake using the values of Leger and Lambert (1982) (see Appendix A).

Sport Tester.

The instrument used to monitor heart rates was the Sport Tester PE-3000, Nor-Am Training Equipment Company. The validity of the instrument was investigated by Karvonen, Chwalbinska-Moneta and Saynajakangas (1984). They reported a comparison of heart rates measured by ECG and Sport Tester microcomputers to have the mean value of heart rates differ at most by ± 5 beats per minute. The Sport Tester is equipped with electrical sensors to measure the pulse of the heart. The electrodes are attached to a light-weight elastic chest strap worn by the participants. Signals are transmitted through the watery layer of the skin on the left side of the participant's chest. The pulse is registered every 30 seconds. Readings are stored in the memory of the instrument. The Sport Tester was found to be an effective instrument to unobtrusively monitor the participant's heart rate responses to physical activity.

3.3 Procedure

The training program occurred at John F. Kennedy School in a gymnasium of size 25m x 10m. The investigator supervised all activities. The classroom teacher asked to be present in order to curtail any possible behavior problems and to aid in the collection of data.

The American College of Sports Medicine (1980) advises that aerobic-type endurance activities with the intensity training of 60% to 90% of maximum heart rate reserve or, 50% to 85% of maximal oxygen uptake must be maintained for 15 to 60 minutes at least three times weekly for several weeks to produce noticeable improvements in cardiovascular fitness. For this study, each participant was actively involved in a training program three days (ie. Tuesday, Wednesday and Friday mornings) per week for 10 weeks. The sessions were 30 minutes in length, with approximately 15 to 20 minutes of activity in order to gradually increase physiological demands on the participants. An average heart rate intensity of 60% was the pursued goal for a minimum of 15 minutes per session.

The modes of activity during each session were aerobic dance, running, and endurance-type games. These activities use large muscle groups, can be maintained continuously, and are rhythmical and aerobic in nature. The sessions commenced with warm-up activities and ended with a cool down. Previous studies have used running (Beasley, 1982; Halle et al., 1983; Tomporowski & Jameson, 1985; Schurrer et al., 1985) and

aerobic dance (Barton, 1982; Montgomery & Reid, 1985) as modes of activity in cardiovascular training programs with mentally retarded persons. These activities seemed to be effective as means to increase the fitness levels of the participants. Activities were selected from these sources. Detailed lesson plans for each session can be found in the Appendix B.

Estimated maximal oxygen uptake was evaluated by performance on the Leger and Lambert Shuttle Run Test. In order to ensure that the participants understood what behavior was required on the test prior to evaluation, the instructor prepared them on four occasions. The participants were taught on a one-to-one basis how to pace themselves with the cadence of the Leger and Lambert test. Graduated guidance instruction was used as a teaching method as suggested by Tomporowski and Ellis (1985). Following the instruction sessions , each participant performed the test for four consecutive days in order to establish a baseline. Thereafter, the test was administered periodically during the training program. To assess whether the participants were performing the Leger and Lambert test at their optimal aerobic capacity, heart rates were monitored with the Sport Tester on four separate testing occasions, intermittently while the training program was implemented.

The heart rates of five of the six participants were also monitored for four sessions during the actual training program (ie. week four, week six, week eight, week nine). Participant

6 refused to wear the Sport Tester hence his heart rate was not monitored. Five minutes prior to activity, they were monitored for a resting heart rate with the Sport Tester. They continued to wear the Sport Tester for the remainder of the session. The ongoing activity and its corresponding time frame was recorded by the classroom teacher. These data were later matched with the comparative heart rates of the participants. Resting heart rates were found to be relatively high; perhaps wearing the Sport Tester produced some anxiety. Hence resting heart rates were monitored with a stethoscope before the fifteenth session while the participants were sitting down at their desks quietly in their classroom.

3.4 Design

It is difficult to study mentally retarded participants in large groups using traditional group research designs because the retarded vary widely in their performance (LaVeck & Brehm, 1978; Watkinson & Wasson, 1984). Additionally, large groups are difficult to find because this population has been widely dispersed into integrated programs. Finally, Watkinson and Wasson (1984) propose that studies should be conducted under naturalistic conditions with small intact groups of three to four participants. Thus group designs may not be feasible nor desirable when working with the mentally retarded.

Previous studies have relied occaisonally on one-group

pretest-posttest program comparisons (Barton, 1982; Schurrer et al., 1985). The pretest-posttest design has a number of difficulties including susceptibilty to the complexity factor of the fitness items. It is the participants' level of fitness rather than their understanding of the task that is to be evaluated. The difference between the pretest and posttest measures may be due to the participants increased familiarity with the test item rather than the increased level of fitness per se.

An alternative to group designs is the single-subject time-series design where multiple measures of the dependent variable are collected on a baseline prior to intervention and where the participants become their own controls (Watkinson & Wasson, 1984). Determining baseline performance has been frequently done in fitness studies with mentally retarded persons (Coleman & Whitman, 1984; Halle et al., 1983; Montgomery & Reid, 1985; Tomporowski & Ellis, 1984, 1985). The single-subject design where the fitness variable is repeatedly measured and in which the participants act as their own control will demonstrate the degree of stability of the dependent variable during baseline.

This investigation employed a single-subject time-series design. A four measure baseline was established to demonstrate stability of the maximal oxygen uptake variable on the Leger and Lambert Shuttle Run Test prior to program intervention. The training program treatment was then

introduced into the time-series for eight sessions, and was followed by the Shuttle Run test. Thereafter, the procedure of three training sessions followed by the test occurred two times. In the last block of the program there were four training sessions followed by four post Shuttle Run tests. Thus the 30 sessions over the 10 weeks comprised four baseline tests, 18 training sessions, four tests between the 18 training sessions and four posttests.

3.5 Treatment of the Data

The data were analyzed to assess: (1) the efficiency of the training program; and (2) the influence of the evaluative component. Two methods were adopted to assess the efficacy of the program.

First, a visual analysis of individual graphs which plot heart rate across time was made. The investigation intended to obtain the participant's maximum heart rates on the Shuttle Run test, since this test demands maximal performance, or during the aerobic program. Neither the Shuttle Run test nor the aerobic training yielded peak heart rates of at least 200 beats per minute (bpm), hence the participants executed both the test and the training at submaximal workloads. Since the average age of the five participants was 21 years with a range of 20 to 22, the equation 220-age (McArdle, Katch & Katch, 1986) would predict a maximum heart rate of 199 bpm. In order to interpret the heart rate data, the heart rates averaged

over every 30 second interim were organised into heart rate intervals utilizing the Karvonen equation. This aided in determining the amount of time during the actual program the pariticpants' were exercising at 60% intensity of maximal heart rate reserve. Also the average scores of the six participants on their four baseline trials and the average scores of their last four trials on the Leger and Lambert test were compared to determine whether performance was enhanced across the sessions.

Second, to assess the evaluative component for all participants, a t-test was to be used. The dependent measure to be compared was the average heart rates for the peak two minute period on the four Leger and Lambert tests with the average peak periods of the heart rate monitored four times during the actual program.

CHAPTER IV

RESULTS

The purpose of the investigation was to assess the consequences of a cardiovascular exercise program on the physical fitness of young adult mentally retarded males. The intention of the investigation likewise was to compare the heart rates elicited during an endurance test with those evoked while performing an actual cardiovascular program. The results will be presented in the following sections: (4.1) participants, (4.2) heart rate response patterns, (4.3) performance on the Shuttle Run and (4.4) evaluative component.

4.1 Participants

The six participants exhibited highly specific individual behaviors during the investigation. Participants 1 and 5 demonstrated what was preceived to be low motivational levels. Participant 1 seemed shy and withdrawn. The instructor periodically had to hold his hand and verbally encourage him to engage in the activities. During the walk-run segment of the session, participant 5 usually walked and often would stop and sway to the music.

Heart rate data were collected on all of the participants

with the exception of participant 6. He refused to wear the Sport Tester. Attempts were made each session to try to alleviate his anxiety for the instrument. He did not like having the strap around his chest.

Participant 2 seemed to have a low tolerance level for physical activity. Throughout the sessions, he always moved at a consistently slow pace. He never pushed himself to overload his cardiovascular system.

These observed individual differences clearly denote that the selected sample was not homogeneous in nature. The differences could be indicative of individual differences in motivational level, cognitive understanding of the tasks, cardiovascular fitness level and tolerance level for physical discomfort.

Five minutes prior to each aerobic session the participants were monitored for a resting heart rate with the Sport Tester. Resting heart rates were perceived to be relatively high. The initial donning of the Sport Tester perhaps produced anxiety. It was anticipated that the stethoscope would not be as anxiety producing as the Sport Tester. Hence resting heart rates were monitored with a stethoscope before the fifteenth session while the participants were sitting down quietly at their desks in the classroom. These resting heart rate responses are reported in Table 2.

Table 2

Resting Heart Rate (bpm) Response Prior to Session #15

Participant	Heart Rate (bpm)
1	72
2	66
3	69
4	67
5	71
Average	69

4.2 Heart Rate Response Patterns

First, the heart rate response patterns are viewed individually across the training sessions and secondly with respect to the intensity elicited during the endurance program. Lastly, the heart rate values obtained during the Shuttle Run test are presented.

4.2.1 Individual Heart Rate Responses Across Sessions

Heart rate responses of all participants during the four monitored sessions are included in Appendix C. Heart rate data collected from participant 3 are presented in Figure 1. These data illustrate the mean heart rates per 30 second intervals achieved during the 26.5 minutes in exercise session #10. They provide a good example of the relationship between the energy requirements of physical activity and heart rate. The activity in the warm-up was of a low intensity and the heart rates ranged from 85 to 95 bpm. As the participant engaged in more strenuous work, moving from the warm-up into the aerobic dance and running segments the heart rates increased. The heart rate values then dropped as expected between the running and the game while he stopped to drink water. The heart rates in the game segment also appropriately reflect the workload since the game was one of fast spurts of running followed by sedentary periods, hence the intermittent

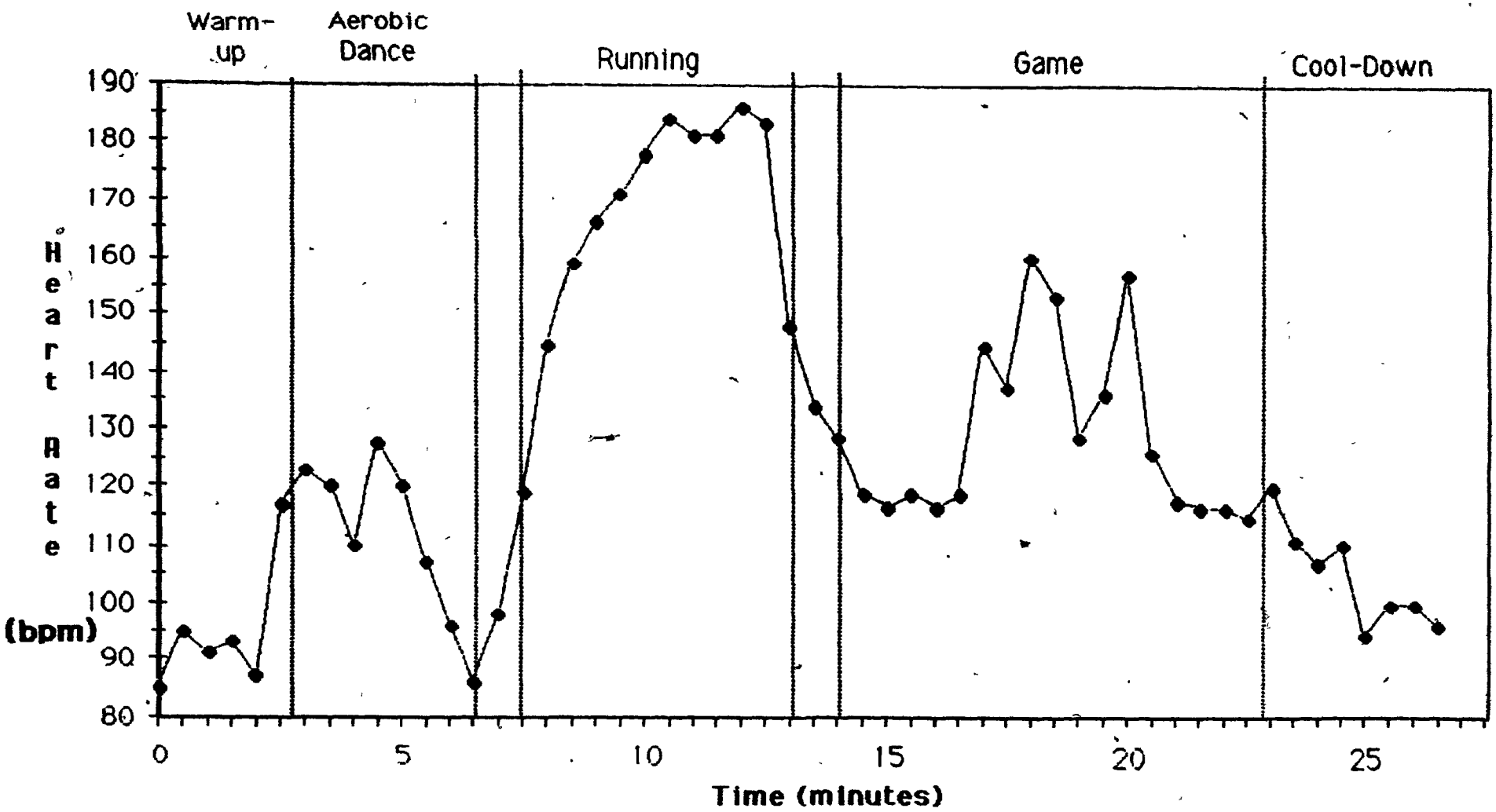

Figure 1: Heart Rate Response of Participant 3 During Session #10

peak heart rates.

4.2.2 Heart Rate Responses to the Endurance Program

The results from the heart rate monitoring during the exercise program are presented in Table 3 according to the amount of time at various levels of intensity. Each participant's heart rate was monitored during four exercise sessions, with the exception of participant 6. He refused to don the Sport Tester and therefore no heart rate data could be collected from him. Utilizing the average age predicted maximum heart rate of 199 bpm, (220-age), and the average resting heart rate of 69 bpm (see Table 2) in the Karvonen equation for exercise percent intensity, the following heart rate intervals were established:

$\leq$ 120 bpm	- $\leq$ 39% intensity
121-133 bpm	- 40% intensity
134-146 bpm	- 50% intensity
147-159 bpm	- 60% intensity
$\geq$ 160 bpm	- $\geq$ 70% intensity

The amount of time exercised at a heart rate greater than or equal to 147 bpm, the minimal intensity required to elicit a

Table 3
Time Per Session that Heart Rates Fell Within Intensity Categories

Exercise Session	Participant	Heart Rate (bpm)				
		≤ 120	121-133	134-146	147-159	≥ 160
		Intensity (%)				
		≤ 39	40-49	50-59	60-69	≥ 70
11	1	19:00*	5:30	2:30	0:30	0:00
11	2	21:00	2:30	3:30	0:30	0:00
10	3	15:30	2:30	2:30	2:00	4:30
12	4	3:00	5:30	6:00	6:00	5:30
12	5	18:00	5:00	2:00	0:00	0:00
16	1	17:00	7:00	5:30	2:00	0:00
16	2	28:00	0:30	0:30	0:00	0:00
15	3	7:00	2:00	7:00	5:30	8:30
15	4	20:00	3:30	5:30	2:30	0:00
17	5	26:30	0:30	0:00	0:00	0:00
21	1	20:30	7:00	3:00	0:00	0:00
20	2	13:30	5:30	3:30	1:00	0:30
19	3	6:00	8:30	4:00	4:30	7:30
19	4	21:30	1:30	2:00	4:00	0:30
21	5	29:00	0:30	0.30	0:00	0:00
24	1	16:00	7:30	3:30	4:00	0:30
23	2	19:30	4:30	5:00	3:30	0:00
25	3	5:00	2:00	6:30	5:30	8:30
25	4	15:30	2:00	4:00	4:00	2:30
24	5	30:00	1:00	0:00	0:00	0:00

* minutes:seconds

training effect (American College of Sports Medicine, 1980), was variable for each participant. For instance, during the 12th session participant 4 elicited a heart rate greater than or equal to 147 bpm for 11.5 minutes, 2.5 minutes during the 15th session, 4.5 minutes during the 19th session, and 6.5 minutes during the 25th session. Individual variability across program sessions also suggests that the variables of motivational level, cognitive understanding of the tasks, cardiovascular fitness level and tolerance for physical discomfort do not always remain consistent for any individual across sessions.

Table 4 indicates that participant 3 was the only one who obtained a heart rate greater than or equal to 147 bpm for over 11 minutes, on average, during an exercise session. The others ranged from 0 to 6 minutes, 15 seconds. According to The American College of Sports Medicine training standards, the heart rates elicited from the participants were not likely high enough, at 60% intensity, for the prescribed amount of time, 15 minutes, to have any substantial benefit from aerobic activity. Participant 3 was the only one who nearly achieved these training standards.

4.2.3 Heart Rate Response during the Shuttle Run

The participants' heart rate responses during the Shuttle Run Test are presented in Table 5. Results indicate that two

Table 4

Time During the Exercise Program that Heart Rates were Greater than or Equal to 147 BPM (60% Intensity)

Exercise Session	Participant				
	1	2	3	4	5
10-12	00:30*	00:30	06:00	11:30	00:00
15-17	02:00	00:00	14:00	02:00	00:00
19-21	00:00	01:30	12:00	04:30	00:00
23-25	04:00	03:30	14:00	06:30	00:00
average	01:45	01:23	11:38	06:15	00:00

* minutes:seconds

Table 5

Heart Rate Response during the Shuttle Run Test

Session	Participant	Initial Heart Rate (bpm)	Peak Heart Rate (bpm)	Time on Shuttle Run (min:sec)
13	1	112	154	2:32
14	2	84	129	2:24
13	3	106	177	5:07
13	4	82	157	3:10
13	5	97	126	1:35
18	1	91	147	2:32
18	2	69	134	2:24
18	3	110	166	4:37
18	4	110	172	4:36
18	5	99	133	2:31
22	1	95	145	2:47
22	2	95	135	2:40
22	3	111	163	4:56
22	4	85	172	4:50
22	5	90	123	2:30
27	1	118	168	3:00
27	2	109	149	2:00
27	3	111	174	5:04
27	4	92	163	3:40
27	5	*	*	2:22
28	1	90	148	3:04
28	2	117	143	2:20
28	3	105	175	4:52
28	4	76	161	4:56
28	5	78	129	2:33
29	1	90	147	2:39
29	2	106	138	2:30
29	3	86	174	4:44
29	4	73	174	4:48
29	5	87	130	2:31
30	1	89	161	3:15
30	2	75	145	2:45
30	3	84	178	5:10
30	4	75	174	5:00
30	5	86	130	2:35

Note. * Sport Tester did not function properly

out of five participants were performing the Shuttle Run with high intensity; these were participants 3 and 4 who elicited heart rates ranging from 157 bpm to 178 bpm. On the other hand, participants 2 and 5 elicited heart rates ranging only from 123 bpm to 149 bpm. Participant 1 displayed large variability in his performance on the run; during some sessions he ran with minimal intensity, similarily to participants 2 and 5, but in others as intensely as participants 3 and 4.

Of significance is the observation that the peak heart rates elicited from the testing sessions were not high enough to be considered as maximum heart rate response. Since a maximum heart rate was not elicited from the participants, the exact percent intensity with which the Shuttle Run Tests and the exercise sessions were performed could not be calculated. This then precluded a comparison of the heart rates obtained during the actual exercise program with those obtained on the cardiovascular endurance test. Consequently, direct assessment of the evaluative factor could not be made.

4.3 Shuttle Run Performance

The effect of the exercise program on the cardiovascular endurance of the six participants was also examined using the results from the Shuttle Run Test. The Shuttle Run times of each participant over the 10 week program are presented in

Table 6. The graphical analyses of the Shuttle Run performance across testing sessions are presented in figures 2 to 7. A four session baseline period prior to initiation of aerobic activities minimized the trial-to-trial variability in performance that is frequently observed in mentally retarded participants. For example, Figure 4 shows that participant 3 produced the following four times on the test during the baseline period - 2:46, 2:15, 4:00, and 3:50. Daily variation in performance cannot be explained wholly as a result of physiological variables; varying degrees of effort was the probable explanation for this change in daily performance.

To minimize the effects that variation in performance due to motivation might have on the results, the average of the four baseline trials on the Shuttle Run test was used. This method produces a test score that more accurately reflects the participants' cardiovascular endurance prior to initiation of the exercise program better than the last baseline score prior to initiation of the program (Campbell & Stanley, 1963). The post-program score was determined by adopting the same procedure that is, the average of the last four trials. The difference between the pre- and post-scores represented aerobic endurance improvement and reflected the effects that the exercise program had on aerobic endurance. The pre- and post testing results for the Shuttle Run and the aerobic improvement are presented in Table 7. Mean results for the six mentally retarded participants gave a pre test score of

Table 6

Shuttle Run Times (minutes:seconds)

Session	Participant					
	1	2	3	4	5	6
1	1:30	1:30	2:46	2:30	1:17	3:15
2	1:22	1:56	2:15	3:00	1:30	3:30
3	2:00	2:04	4:00	3:17	1:09	3:01
4	2:00	1:50	3:50	3:10	1:08	3:26
* 5			3:52			
13	2:32	abs	5:07	3:10	1:35	3:44
14		2:24				
18	2:32	2:24	4:37	4:36	2:31	4:00
22	2:47	2:40	4:56	4:50	2:30	4:00
27	3:00	2:00	5:04	3:40	2:22	4:37
28	3:04	2:20	4:52	4:56	2:33	5:08
29	2:39	2:30	4:44	4:48	2:31	4:52
30	3:15	2:45	5:10	5:00	2:35	5:00

Note. abs=absent, * additional session for participant 3 to stabilize the baseline

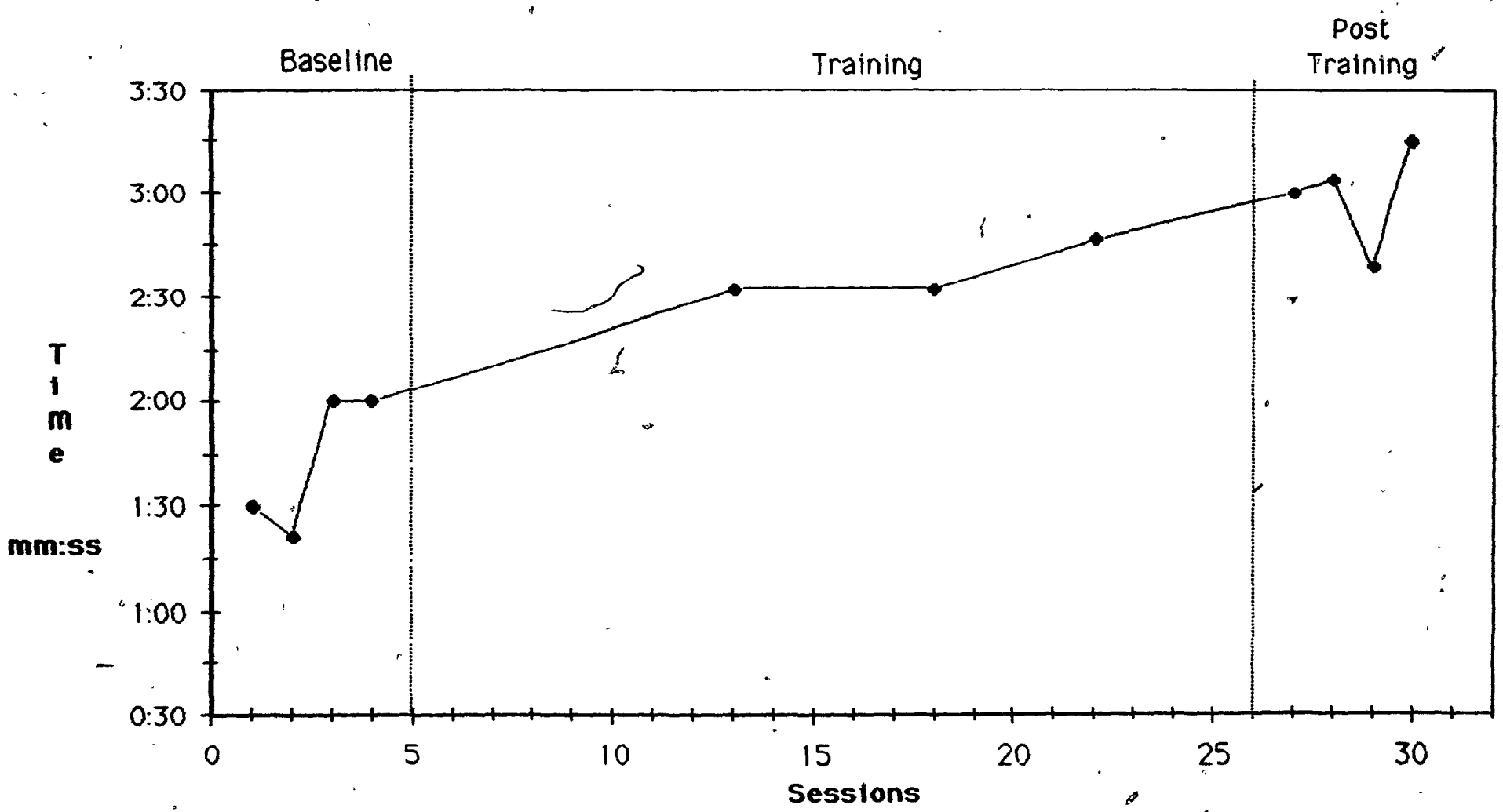

Figure 2 Shuttle Run Times of Participant 1

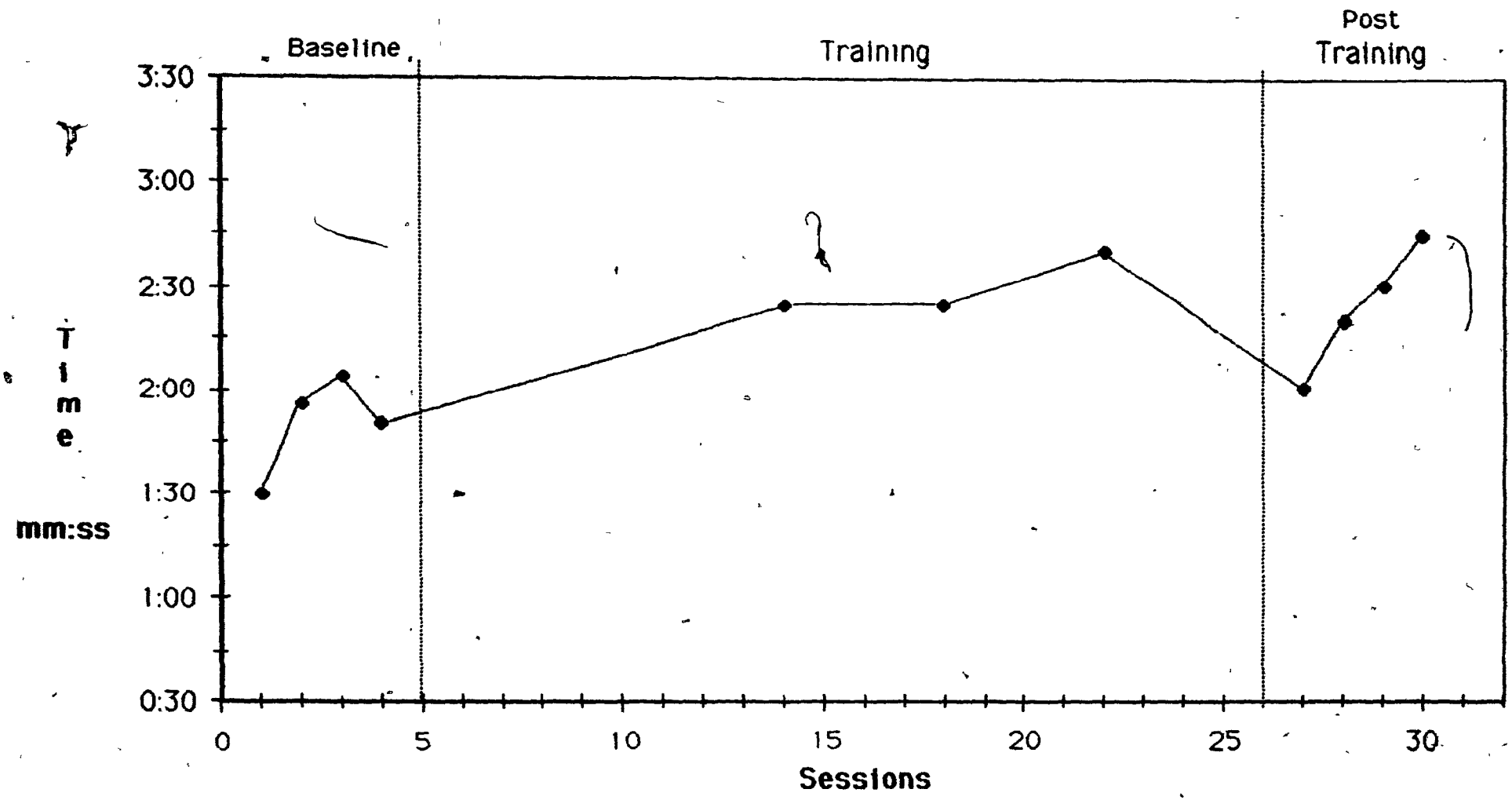

Figure 3: Shuttle Run Times of Participant 2

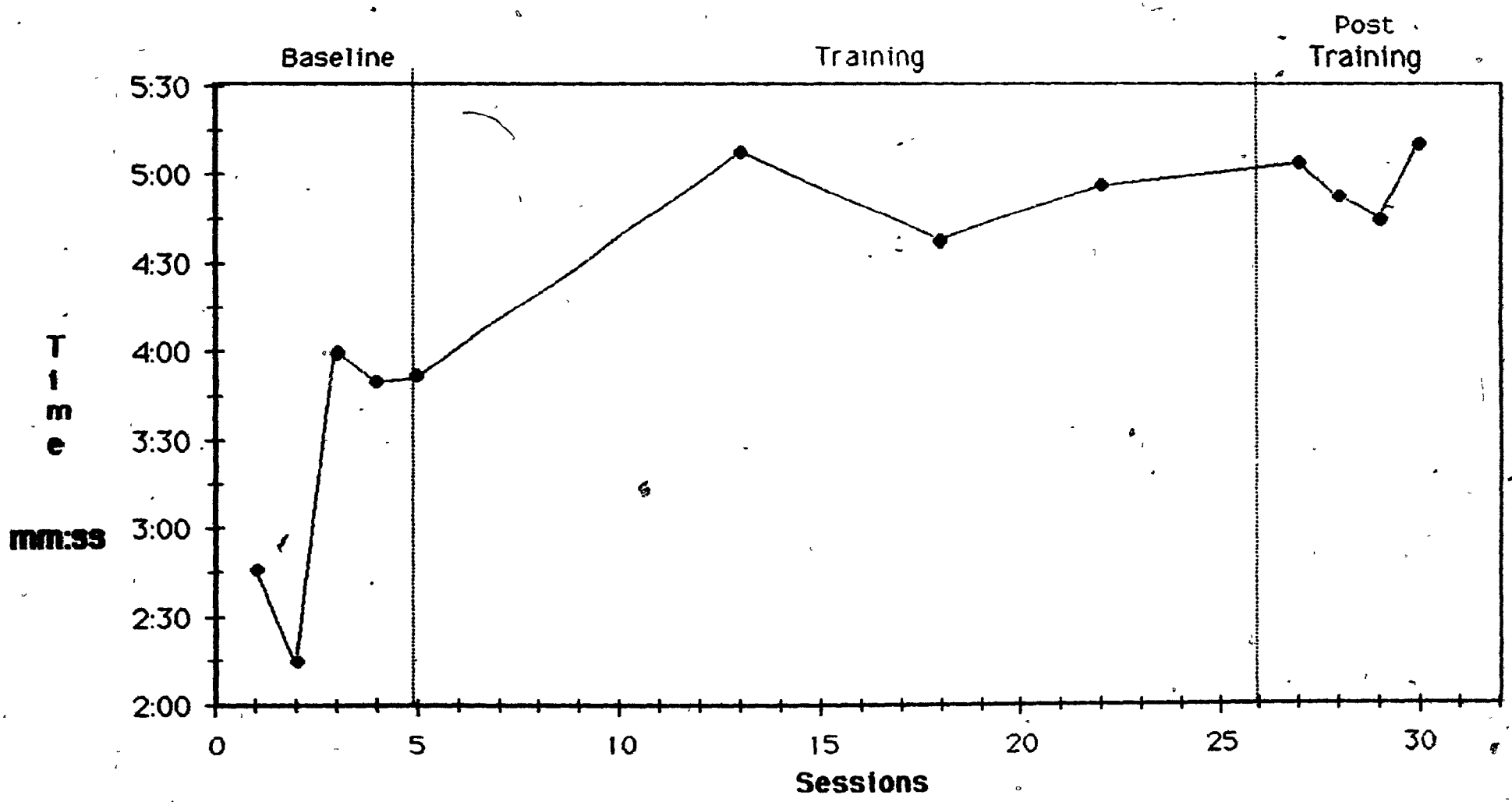

Figure 4: Shuttle Run Times of Participant 3

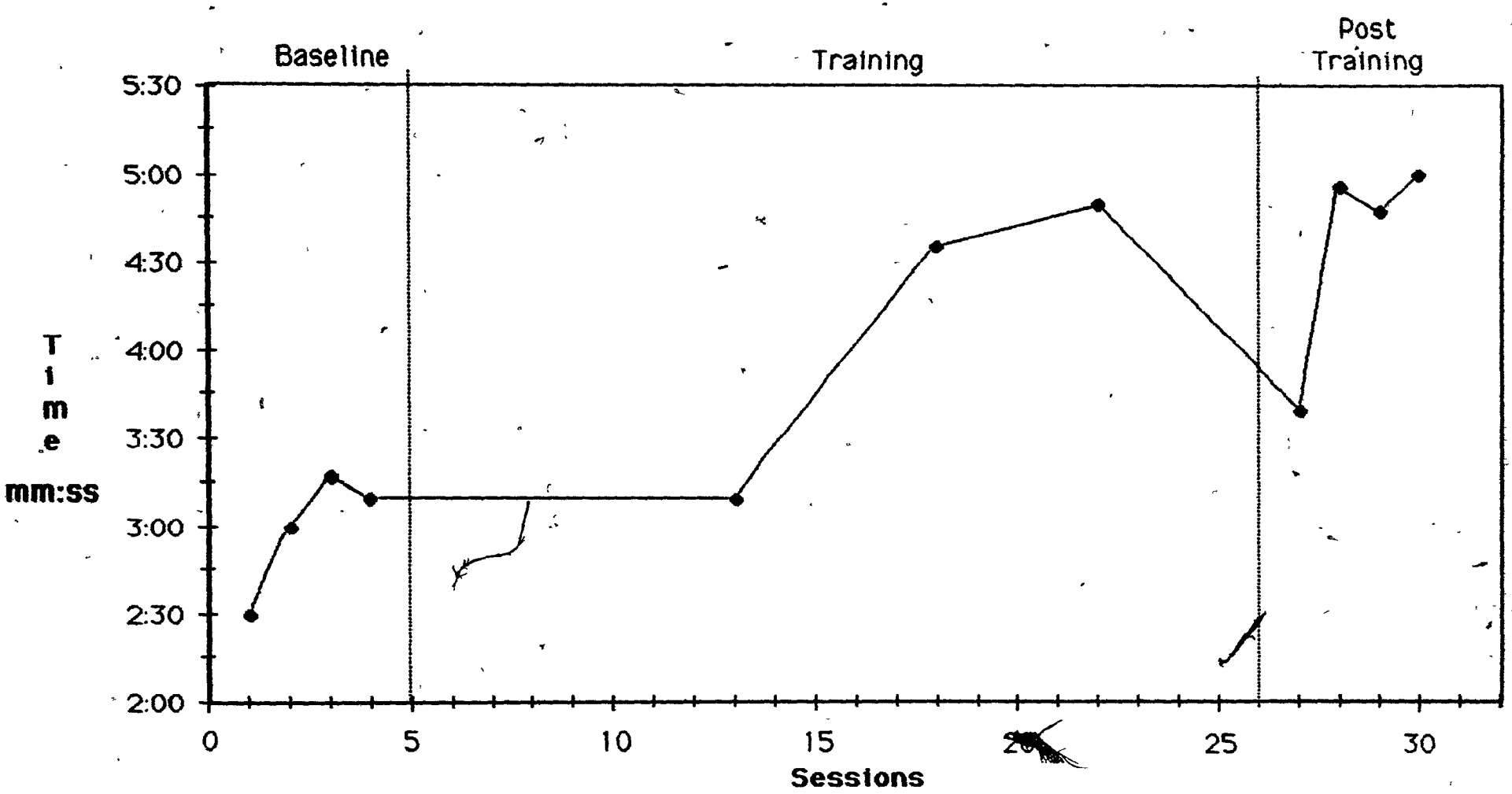

Figure 5: Shuttle Run Times of Participant 4

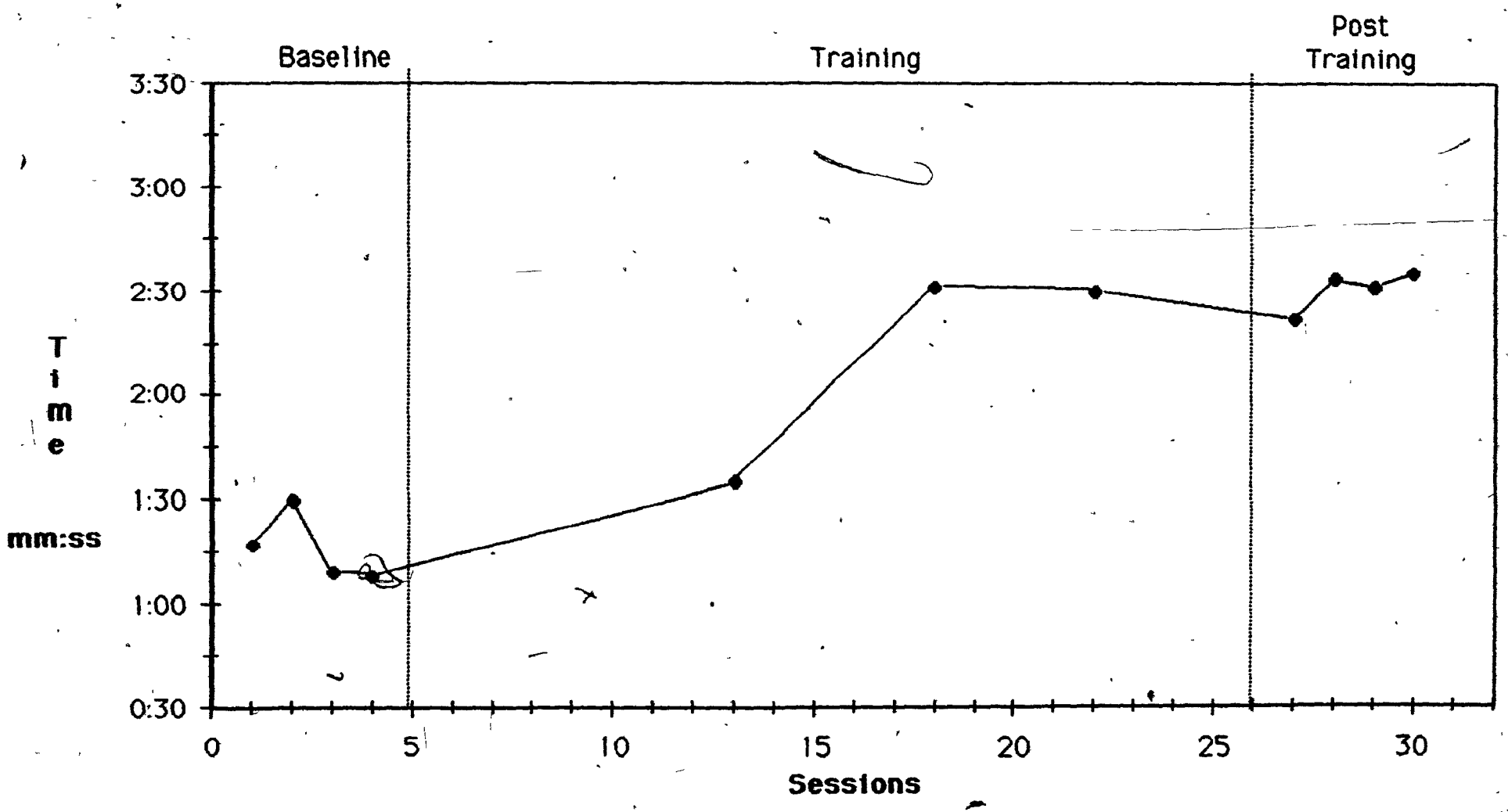

Figure 6: Shuttle Run Times of Participant 5

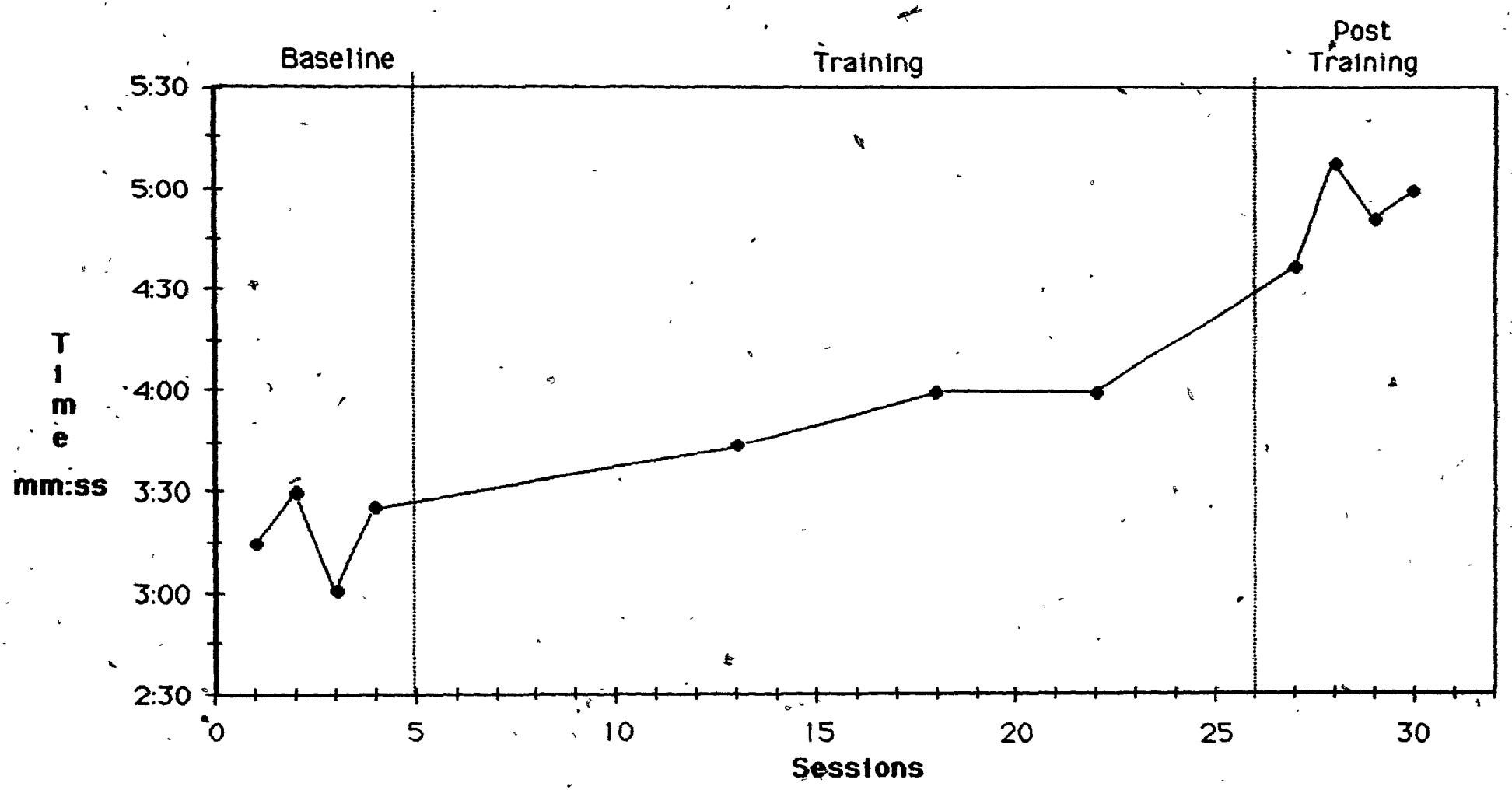

Figure 7: Shuttle Run Times of Participant 6

Table 7

Pre- and Post Program Results of the Shuttle Run Test (minutes:seconds)

Participant	Average of 4 Trials in Base-Line Period	Average of 4 Trials in Final Segment	Improvement Time	Absences During Program
1	1:34	2:59	1:25	1
2	1:50	2:24	0:34	2
3	3:13	4:57	1:44	0
4	2:59	4:33	1:34	2
5	1:16	2:30	1:14	0
6	3:18	4:54	1:36	0
Average	2:22	3:43	1:21	

2:22 and a posttest score of 3:43 on the Shuttle Run Test. The increase of 1:21 illustrates an improvement in aerobic endurance that is attributed to the exercise program.

Using the values of Leger and Lambert (1982), the times in the Shuttle Run Test can be converted into predicted estimates of maximal oxygen uptake. Completion of workload 1 (2:00) represents a maximal oxygen uptake value of 24.5 ml/kg.min. Completion of workload 2 (4:00) represents a maximal oxygen uptake value of 31.5 ml/kg.min. The post program score, 3:43, indicates that only 85.8% of workload 2 was completed which corresponds to a maximal oxygen uptake value of 30.5 ml/kg.min. Thus, the mentally retarded adults increased their maximum oxygen uptake by approximately 4.72 ml/kg.min which illustrates a 18.3% improvement in cardiovascular endurance.

4.4 Evaluative Component

As viewed in the heart rate response patterns of the five participants, the data elicited during the aerobic program and the Shuttle Run did not provide maximal heart rate values. Participants 3 and 4 were the only two who elicited relatively high heart rates during both the program and Shuttle Run. Table 8 displays the participants' peak heart rates for the four aerobic sessions and Table 9 presents the heart rates of the corresponding testing sessions. The heart rates are

Table 8

Peak Heart Rates During the Training Sessions

Participant	Training Session	Heart Rate (bpm)
1	11	148
	16	156
	21	138
	24	162
2	11	150
	16	134
	20	165
	23	155
3	10	186
	15	177
	19	179
	25	177
4	11	169
	15	157
	19	164
	25	164
5	12	140
	17	122
	21	140
	24	122

Table 9

Peak Heart Rates During the Shuttle Run Test Sessions

Participant	Test Session	Heart Rate (bpm)
K	13	154
	18	147
	22	145
	27	168
2	14	129
	18	134
	22	135
	27	149
3	13	177
	18	166
	22	163
	27	174
4	13	157
	18	172
	22	172
	27	163
5	13	126
	18	133
	22	123
	27	*

Note. * not available due to malfunction of Sport Tester

elevated but not high enough to conclude that they are maximal values.

Consequently, it was impossible to perform a t-test to determine if there were any significant differences in the heart rates obtained during the actual program with those obtained on the cardiovascular endurance test.

CHAPTER V

DISCUSSION

The purpose of this investigation was to observe the effects of a cardiovascular exercise program on the physical fitness of young adult mentally retarded males. In addition, the heart rates obtained during the endurance test were to be compared with those obtained while performing an endurance exercise program. The present chapter discusses: (5.1) exercise intensity: hypothesis 1, (5.2) cardiovascular improvement: hypothesis 2, (5.3) evaluative component: hypothesis 3 and (5.4) general discussion.

5.1 Exercise Intensity: Hypothesis 1

The American College of Sports Medicine (1980) training guidelines suggest that continuous activity of the large muscle groups must be executed three to five times per week for 15 to 60 minutes at an intensity of 60% to 90% of the maximum heart rate reserve in order to improve cardiovascular fitness. In this investigation, the participants were engaged in physical activity for three consecutive sessions per week. The sessions were 25 to 30 minutes in length and included a warm-up, three aerobic activities (i.e. aerobic dance, running and a running game) and a stretching period. The aerobic

segment of the session was on the average 23.5 minutes in length. This was not continuous however, because the participants had to relocate themselves in the corner of the gym after the aerobic dance to start their running. After running, they would stop for a drink of water and then get themselves into a circle formation for the Slap Jack game. These intermissions were approximately one to two minutes in duration.

In addition to these interuptions, the participants would also individually stop during the aerobic segment. Participant 1 tended to stop during the aerobic dance and running, so the instructor would hold his hand and perform the activity with him for a short period of time and then verbally encourage him to continue. After the running, participant 6 used to go for a drink of water and would sometimes stay in the washroom for five minutes therefore missing part of the game. On the day of session #21, for no apparent reason participant 4 refused to engage in the program. A variable that seemed to affect the overall continuity of the session was the location of the gym; that is, to get from one section of the school to the other , classes of children had to walk through the gym, thereby often disrupting the program. The participants would stop or slow down to see what was going on.

The aerobic dance segment of the program was a "follow me" activity. The instructor led the participants through the movements and at the same time used verbal encouragement and

praise as reinforcement. Details of the dances are in the lesson plans in Appendix B. For the running segment, the participants were told to run around the gym as many times as they could until the music stopped. The running space was marked off with pylons so that they would not cut corners. The classroom teacher kept a tally of the number of times they ran around the gym, not for data purposes but to use for praise e.g. "that was very good, you ran around the gym 10 times today".

Because Slap Jack (see Appendix B) was not a continuous game, the instructor made sure that each participant had at least two turns being "It" hence everyone was periodically moving. In order to increase the intensity of the game from session #19 on, to complete one turn "It" had to run around the circle two times before stopping at his chasers previous place. Instead of changing the game every session, Slap Jack was kept in the program. Other games that were familiar to the participants did not promote cardiovascular endurance and to teach new games throughout the program would have used valuable time. They enjoyed Slap Jack and nature of the game promoted socialization which the classroom teacher wanted to encourage. Most of all, they became familiar with it and understood the required task much better each time they played. The participants looked forward to playing Slap Jack and it became the "highlight" of the session.

According to hypothesis 1, the aerobic type activities

executed during a 30 session endurance program were to elicit an exercise heart rate intensity of 60%. Using the average age predicted maximum heart rate and the average resting heart rate (Table 2) in the Karvonen equation to establish heart rate intervals, the results revealed that the participants typically exercised at less than 60% intensity. Only one averaged a 60% exercise intensity for 11 minutes and 38 seconds which is close to but not the minimum requirement of 15 minutes. The low exercise intensities exhibited by the participants during the aerobic segments do not provide support for hypothesis 1.

The intensity exercise behavior that was observed in this study is both consistent and inconsistent with previous research. Kamimura and Kusano (1981) reported that Down Syndrome children are inactive and show little periodic change in heart rate levels during strenuous activities. Maksud and Hamilton (1974) found that their educably mentally retarded subjects failed to attain maximal exertion as was evidenced in low peak heart rates. Thus these two studies demonstrate that mentally retarded individuals seem to exercise at low intensity levels. On the other hand, both Koh (1986) and Depauw et al. (1985) reported that high exercise intensities, as reflected by heart rates, were elicited by their moderately retarded subjects during aerobic tests of endurance. Koh's subjects were mildly retarded and DePauw's et al. were moderately retarded. The present study used lower functioning

subjects and thus it appears their motivation to maintain high levels of exercise intensity is more problematic than the subjects in the DePauw et al. and Koh studies. Tomporowski and Jameson (1985) suggested that intensity of exercise depended upon the mode of activity. The treadmill as opposed to the stationary bicycle or rowing machine was the most effective instrument to use to ensure continuous exercise at a cadence considered to improve aerobic fitness. In the present investigation the pace for the Shuttle Run was internally determined like that of the stationary bicycle and rowing machine. Hence, the exercise intensity was up to the participant.

Intensity of exercise is one of the key factors effecting aerobic training. For a training program to promote aerobic fitness, the intensity of overload should be sufficient enough to increase the heart rate to about 60% of maximum (American College of Sports Medicine, 1980). The participants in this investigation performed at an exercise intensity that was below the recommended minimal threshold level that would produce aerobic training effects. This observation was also apparent in previous research where retarded individuals exercised at low intensity levels (e.g. Maksud & Hamilton, 1974; Tomporowski & Jameson, 1985).

5.2 Cardiovascular Improvement: Hypothesis 2

According to hypothesis 2, the participants were to improve their level of aerobic fitness, as measured by the Leger and Lambert Shuttle Run, following a cardiovascular endurance program. The Leger and Lambert test is a field test that indirectly predicts maximal oxygen uptake from the highest workload achieved. It is a progressive multi-staged test. It is not sophisticated in equipment; only 20 metres of space is required and hence it can be performed in a gymnasium. The protocol is simple and the cadence is predetermined. The Shuttle Run has been used successfully with mentally retarded adults (Montgomery & Reid, 1985). Even though the Leger and Lambert test can be executed in a group, in this investigation participants 3 and 4 did the test together and the other four did it individually. Before baseline scores were collected, the test was introduced and practised on four occasions by the participants so that they would understand the protocol. During these practise sessions, it was observed that participants 1,2,5 and 6 were not adhering to the predetermined pace; hence, the instructor performed the test with each of these four individually. Participants 5 and 6 were told to try to keep up with the instructor. Participants 1 and 2 held hands with the instructor, because even at the onset of the testing session, they were not following the cadence. Instructor intervention

proved to be necessary for motivational purposes and to ensure that the test protocol was adhered to properly. An attempt was made to overcome testing obstacles experienced by previous investigators as reported in the review of the literature (e.g. Nordgren, 1971; Reid et al., 1985; Tomporowski & Jameson, 1985).

The improvement in the predicted maximal oxygen uptake from pretest to posttest averaged 18.3%. The American College of Sports Medicine's position statement (1980) on the recommended quantity and quality of exercise for developing and maintaining fitness in healthy adults claims that significant improvement ranges from 5% to 25%. Changes in maximal oxygen uptake have been shown to be greater than 25%; for example, Schurrer et al. (1985) observed a mean increase of 43% in their mentally retarded adults. However, changes of such magnitude are usually associated with large total body mass and fat weight loss or a low initial level of fitness (American College of Sports Medicine, 1980).

Improvement in cardiovascular fitness is dependent upon the intensity, duration and frequency of the exercise program (Pollock, Wilmore & Fox, 1978, p.38). Improvement is also related to the initial status of health and fitness, the mode of exercise and to individual interests. This investigation employed aerobic-type activities three sessions per week for 10 weeks. The cardiovascular activities lasted for approximately 23.5 minutes out of a 30 minute session. The

recommended quality and quantity of exercise seems to have been adhered to with one exception, as described in in the previous chapter (Table 4), the participants' exercise intensity was not reaching the minimal threshold level for eliciting a training response. However, programs of an intensity of less than 60% of maximum capacity will often produce improvement in individuals with low initial fitness levels (American College of Sports Medicine, 1980; Pollock et al., 1978, p.121). In this study, the initial status of the participants' cardiovascular fitness levels was determined during the baseline testing. The mean maximal oxygen uptake value was 25.8 ml/kg.min. When this value is compared with that of nonretarded adults it is clearly found to be low, therefore indicating that this particular group of retarded males had a low initial fitness level (Sharkey, 1970; Wilmore, Davis, O'Brien, Vodak, Walder, Amsterdam, 1980). With respect to the literature on the physical fitness levels of mentally retarded adults (e.g. Depauw et al., 1985; Nordgren,1971; Reid et al., 1985) one can also assume that the participants' initial fitness levels were low. In sum, the participants improvement in cardiovascular endurance does seem meaningful. The better performances on the Leger and Lambert Shuttle Run from pre- to post testing combined with a 18.3% improvement in predicted maximal oxygen uptake do provide support for hypothesis 2.

This investigation found an improvement between pre- and

post-baseline scores on the running test, and an 18.3% improvement in predicted maximal oxygen uptake was realized. Yet when exercise intensity was measured during the aerobic sessions , it was observed that the participants were not exercising at the recommended minimal threshold for eliciting a training response (American College of Sports Medicine, 1980). These two findings seem to contradict one another. This implies that, with the participants in this study, interpreting the effectiveness of the aerobic training program could not have been determined by only considering the Leger and Lambert test scores. The improvement in their cardiovascular fitness was dependent upon the intensity, duration and frequency of exercise, as well as, on their initial fitness level, their individual motivation and the mode of activity. Perhaps the recommended minimal exercise intensity of 60% is too high a standard for mentally retarded persons or others of low initial fitness level. As seen in the literature, mentally retarded persons tend to be externally motivated (Caouette & Reid, 1985; Montgomery & Reid, 1985; Wagner, 1967). This study did not employ a motivational system hence low motivational levels may have been reflected in exercise effort.

5.3 Evaluative Component: Hypothesis 3

Hypothesis 3 stated that the participants would

demonstrate a higher level of exercise intensity during the aerobic program than during the cardiovascular endurance testing. The expectation that the Leger and Lambert Shuttle Run would not effectively elicit the maximal exercise intensity of the participants was due to the possible factors influencing test performances observed in previous fitness testing studies. Studies have commonly reported variables that seem to affect assessment such as physical complexity, incomplete understanding of the task and perceived evaluative threat (Fait & Kupferer, 1956; Gottlieb, 1982; Koh, 1986; Maksud & Hamilton, 1974; Seidl, 1986; Tomporowski & Jameson, 1985). Since these variables may effect the performance of mentally retarded persons in an evaluative situation, it was hypothesized that the participants would be exercising during the program at a higher intensity that would not be reflected in the testing results.

In order to assess whether or not the participants elicited a higher exercise intensity while training than in the Leger and Lambert test, periods of maximal work output had to have been accomplished so that maximum heart rates would have been elicited. It was anticipated that maximal heart rates would have been evoked during either situation. Unfortunately the peak heart rate values from both the program and the test were not high enough to allow comparison of exercise intensity. Due to insufficient data, therefore, hypothesis 3 was not assessed.

5.4 General Discussion

The present investigation proved that a physical exercise program with emphasis on cardiovascular endurance activities resulted in improved aerobic fitness as measured by the Leger and Lambert Shuttle Run test. Thus, it further substantiated the evidence that mentally retarded persons are able to perform in and benefit from quality and quantity exercise programs (e.g. Barton, 1982; Beasley, 1982; Halle et al., 1983; Montgomery & Reid, 1984; Mulholland & McNeil, 1985; Schurrer et al., 1985; Tomporowski & Ellis, 1984; Tomporowski & Jameson, 1985).

Results of the investigation also revealed that monitoring heart rate responses during a physical activity program is an effective means to demonstrate the exercise intensity of mentally retarded adults. A drawback that this study encountered was the fact that maximum heart rate values were not attained; hence, predicted maximum heart rate had to be adopted when determining exercise intensity. Accepting a common maximum heart rate for individuals differing in fitness levels is reported to cause an overestimation of maximal oxygen uptake in athletes and a further underestimation in sedentary individuals (Shephard, 1977, p.129). Despite the absence of maximal values, the heart rate data collected provide clear examples of the association between the work output and physiological response.

Comparing the peak heart rate values obtained in this investigation with those reported in the literature, it would seem that both the aerobic program and the Leger and Lambert test in this investigation approximated submaximal performance. For the participants under the specific setting and procedures of this investigation, the Leger and Lambert Shuttle Run was a submaximal field test. Likewise Maksud and Hamilton (1974) reported that the peak heart rates reached by 62 educable mentally retarded boys during a maximal bicycle ergometer test were lower than values generally reported for adolescents who are either mentally retarded or nonhandicapped. The authors attributed their results to the type of activity, lack of motivation and lack of strenuous daily activity. The heart rate response findings of this investigation and of Maksud and Hamilton's are not consistent with other investigations. For example, Koh (1986) obtained group mean maximal heart rates for 10-12 year old educably retarded experimental and control subjects of 196.6 bpm and 192.6 bpm while performing the Canada Fitness Award-Adapted Endurance Run. The 13-and-older experimental and control subjects elicited lower group mean maximal heart rates of 186.3 bpm and 187.2 bpm respectively. Depauw et al. (1985) also reported high heart rates reached by nine moderately retarded adolescents during a 12 minute run. The values were at 85% of predicted maximum heart rate, and in some cases, even above the predicted maximum itself. Both Koh (1986) and

DePauw et al. (1985) demonstrated that mentally retarded persons are capable of eliciting high heart rates while exercising. Their findings may be different from those of the present study because of the retardation of the subjects. Koh's subjects were mildly retarded and DePauw et al.'s were moderately retarded, whereas in this study the participants ranged from being at the low end of the moderately retarded scale to being severely retarded.

One obvious explanation for lower heart rate findings in this study is low levels of motivation, resulting in lower work output during training and a tendency to end the Leger and Lambert test before maximal values were attained. Considering the tendency for mentally retarded persons to generally be passive during leisure time and to lack habitual activity (Bauer, 1981; Broadhead, 1981; Cheseldine & Jeffree, 1981; Maksud & Hamilton, 1974; Reiter & Levi, 1981; Speakman, 1977), prefer familiar and unchallenging tasks (Harter, 1977) and have low levels of fitness (Coleman et al., 1976; Nordgren, 1970, 1971; Reid et al., 1985), it is not surprising to see that these individuals do not persevere with intensity at a task that is physically demanding and perhaps discomforting.

It is possible that the mode of activity used was the reason for performances of low intensity. The aerobic dance movements were familiar, repetitive actions consisting mainly of jumps and jogging. The weakness in using dance as an

aerobic activity is that people tend to concentrate on following the leader and try to anticipate what will come next and this stops them from putting all their effort into the movements. Barton (1982) found that the educably mentally retarded subjects performed the aerobic dance at a lower intensity level while in the learning stages of new dance routines. For some, to coordinate movements may be simple but for others more difficult. Dance is an activity that requires a series of movements in which subsequent movements are built upon previous movements. Hence, the inability to coordinate the movements leads to failure and frustration (Fait & Kupferer, 1956). Mentally retarded children lag behind children of normal intelligence in motor proficiency and this lag tends to increase with age (Francis & Rarick, 1959; Rarick et al., 1970). Additionally, retarded children have more difficulty in performing tasks that require the coordination of a series of movements than those that require one basic movement (Fait & Kupferer, 1956). Perhaps the dance movements in this investigation were difficult to coordinate.

Understanding the aim and the rules of the game may have hindered the participants' performances during Slap Jack. At the onset of the program the game was new to all the participants, hence the intensity at which it was performed was low. As the sessions progressed, they became more familiar with it and it was apparent that they were starting to understand the objective (i.e. to run as fast as they could

to catch the opponent). The conditions, namely motivation and task complexity, may have contributed to the generally low exercise intensity observed by the young adult mentally retarded males in this investigation.

The participants' heart rate responses to the aerobic training session follow the normal trend of those of nonretarded persons (see Appendix C) The heart rate values increased as the activity became more strenuous (e g. warm-up compared to aerobic dance) and as the duration of the activity increased (e g warm-up plus aerobic dance plus running) In general, the participants sustained higher exercise intensity levels during the running segment of the aerobic training than during the dance and the game of Slap Jack A possible reason for this observation is because running is a familiar and easy locomotive skill. The aerobic dance required skill in body coordination, and Slap Jack was a discontinuous game that required an understanding of the aim and the rules

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of the investigation was to observe the effects of an endurance training program on the aerobic fitness of young adult mentally retarded males. Additionally, the investigation intended to compare the heart rate responses elicited during the endurance test with those obtained during the actual cardiovascular training program. This chapter is divided into five sections (6.1) summary of procedures, (6.2) summary of results, (6.3) conclusions, (6.4) implications of the research and (6.5) recommendations for further study.

6.1 Summary of Procedures

The participants in this investigation were chosen as an intact group from a special education school in Beaconsfield, Quebec. The mean chronological age of the participants was 21 years ranging from 19 to 22 years. The participants had a mean IQ of 35.6 with a range from 27 to 46.

The investigation took place three days a week for 10 weeks in the school gymnasium. The participants learned and practised the Leger and Lambert Shuttle Run test protocol on four occasions before pretesting occurred. Baseline data on

this test was then collected on four consecutive days. Following baseline, the participants were engaged in a training program for eight sessions before the Leger and Lambert test was administered again. The training program continued for three sessions and again was followed by the Leger and Lambert test. This pattern of three training sessions followed by one of testing was repeated two additional times. Posttesting on the Leger and Lambert test occurred during the last four sessions of the investigation.

Using the Sport Tester, heart rates were monitored on four separate sessions while the participants took part in the training program Heart rate data were also collected during the Leger and Lambert tests that followed the baseline data collection. With the exception of one participant who refused to wear the Sport Tester, heart rate responses of the mentally retarded males were documented for an aerobic training program on four occasions and for the Leger and Lambert field test on four occasions.

In order to interpret the heart rate data and to determine whether the participants exercised at an intensity of 60%, the predicted maximum heart rate was used in the Karvonen equation to calculate percent intensity. To determine whether the Leger and Lambert test performance was enhanced across sessions, the average scores on the four baseline trials and the average scores of the last four trials were compared.

The evaluative component of the investigation was to be assessed. The dependent measure to be compared was the average heart rates for the peak two minute period on the four Leger and Lambert tests with the average peak periods of the heart rate monitored four times during the actual training program.

6 2 Summary of Results

6.2.1 Exercise Intensity: Hypothesis 1

It was hypothesized that the participants in this investigation would elicit 60% of their maximum heart rate reserve during a cardiovascular fitness program. Thus, they would be exercising at the minimal threshold level for eliciting a training response according to the American College of Sports Medicine (1980). The intensity of training is dependent upon the mode of activity and the duration of activity. The investigation adopted three types of endurance activities, namely, aerobic dance, running and a running game. These activities used large muscle groups and were rhythmical and aerobic in nature. The aerobic dance and running were maintained continuously. The duration of the activities averaged approximately 23.5 minutes per session, and the sessions were held three days per week for 10 weeks. When the exercise intensity was caculated using the predicted maximum

heart rate, it was found that the participants had not been eliciting a 60% threshold level. Therefore, hypothesis 1 was not supported.

6.2.2 Cardiovascular Improvement: Hypothesis 2

The second hypothesis tested in this investigation asserted that the participants would improve their level of aerobic fitness, as measured by the Leger and Lambert Shuttle Run. The data supported this hypothesis as evidenced by the comparison between the pre and post baseline outcomes. An improvement in maximal oxygen uptake was realized when the Leger and Lambert test was used to indirectly predict the functional capacity of the cardiorespiratory system. It appears that the aerobic exercise program which encompassed the recommended quantity and quality of training enhanced the cardiovascular fitness of the mentally retarded participants.

6.2.3 Evaluative Component: Hypothesis 3

It was hypothesized that the mentally retarded participants would achieve and maintain a higher exercise intensity during the aerobic training than during the cardiovascular fitness testing. The hypothesis was put forth due to the confounding variables that have been postulated in the research on cardiovascular fitness testing with mentally

retarded persons (Gottlieb, 1982; Koh, 1986; Maksud & Hamilton, 1974; Seidl, Reid & Montgomery, 1987; Tomporowski & Jameson, 1985). The heart rate data in both the training program and in the testing failed to provide evidence of high intensity work, hence comparison of exercise intensity was not carried out. Consequently, hypothesis 3 was not evaluated.

6.3 Conclusions

Supported by the results and within the limitations of this investigation, it was found that a physical exercise program emphasizing cardiovascular endurance afforded an improvement in aerobic fitness. It was determined that monitoring heart rate responses during a physical activity program is an effective medium to ascertain the exercise intensity of mentally retarded adults.

6.4 Implications of the Research

The intra-individual differences in performance during the baseline on the Shuttle Run test clearly demonstrate that wide variability exists within the moderately and severely retarded population. These differences are indicative of the discrepancies in levels of motivation, cognitive understanding of the task, tolerance level for discomfort and preceived evaluative threat. These confounding variables reinforce the

contention that determining the degree of stability of the dependent variable with a baseline is a necessary procedure.

Another method to evaluate severely retarded individuals' physical capacities is to document heart rate responses during activity. It is an unobtrusive avenue that provides an objective indication of the level of physical demands at which the severely retarded adult is working. The results of this investigation revealed that the retarded males' cardiovascular responses to physical activity follow a pattern that one would normally expect. There was no asymmetry in the heart rate patterns that could generate questions as to whether accepted procedures to assessing the heart rate responses would be inadequate for these participants. Additionally, non-performance based data of this nature reveal specifically what is occuring in the cardiorespiratory system.

Heart rates elicited during the training sessions suggested that the participants were exercising at lower intensities than the recommended minimal threshold for producing a training effect. Since performances on the Shuttle Run test suggested an 18.3% improvement in cardiovascular fitness, a training effect did occur even though the actual exercise intensity was not one that was recommended to elicit improvement. Hence, a more liberal approach must be taken to interpret the minimal threshold intensity that the moderately to severely retarded population must attain in order to evoke an aerobic training effect.

6.5 Recommendations for Further Study

The participants in this investigation seemed to lack the motivation to perform with high intensity during the aerobics segment of the training program. It was observed that their exercise intensities were below the recommended minimal threshold of 60% to elicit a training effect. Motivation seemed also to have an effect on the Leger and Lambert test. This field test is supposed to elicit maximal work output, and the participants did not reach maximal performance as was evident in their low peak heart rate values. This investigation did not implement a specific motivational system. The participants were only verbally encouraged and praised while they engaged in the activities. Future research should consider enforcing a motivational system during the training program so that high intensities are reached and maintained. As reviewed in the literature, Halle et al. (1982) used various motivational techniques which were deemed effective. Also a system should be implemented for the testing situation, for example, establishing running goals and providing rewards in order to elicit maximum heart rates (Montgomery & Reid, 1985).

The American College of Sports Medicine (1980) suggests that the intensity of the exercise overload should be at a minimal threshold of 60% of maximum heart rate reserve to observe training improvement. The participants in this study

were exercising below the recommended standard for intensity. Perhaps mentally retarded persons have a different minimal threshold. Because improvement in cardiovascular endurance depends not only on intensity but also on the frequency and duration of exercise, another study could examine the training effect of an aerobic program where the frequency and duration of the training sessions and program are increased (Pollock et al.,1978). Since mentally retarded persons tend to exercise at lower intensities, a daily aerobic program that endures for a longer period of time both during the session and in the length of the program will likely produce a greater training effect.

Two procedures were not included in this research. One was the consistent monitoring of resting heart rates. Documenting the resting heart rates of the participants throughout the investigation would have provided an additional method to evaluate the cardiovascular training effectiveness, since aerobic conditioning can decrease resting heart rates. An additional procedure that would have provided insight of the initial fitness level and the aerobic fitness progress would have been to record the participants' recovery heart rates five to ten minutes after exercise. Better physical condition decreases the amount of time required for the heart rate to return to normal after exercise. A slow recovery of heart rate towards the pre-exercise value suggests a low level of cardiovascular endurance. An improved recovery rate is an

indication that the fitness condition is ameliorating.

Another investigation that could develop from the present one would be to use the Leger and Lambert Shuttle Run Test on a larger sample of severely mentally retarded persons. Advantages of the test are that it has a predetermined cadence, and that it can be used with a group of people hence it is not time consuming. In this investigation only two of the participants were able to follow the pace and perform the test in a group. The others had to perform it individually because they failed to adhere to the pace, therefore were physically and visually prompted by the instructor on a one-to-one basis. Another study with a much larger sample size of severely retarded persons could determine if this test could in fact be used in a group situation where the pace is properly adhered to.

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APPENDIX A

The Maximal Multistage 20 m Shuttle Run Test For The Prediction Of Aerobic Capacity (Leger & Lambert, 1982)

Workload	Time (min.)	Speed (km/hr)	Fraction Time (sec/20m)	VO2 Max (ml/kg.min)
1	2	7 51	9.693	24.5
2	4	8.70	8 276	31.5
3	6	9 30	7.744	35.0
4	8	9 90	7.276	38.5
5	10	10.49	6.862	42.0
6	12	11.09	6.492	45.5
7	14	11.69	6.160	49.0
8	16	12.29	5.860	52.5
9	18	12.88	5.589	56.0
10	20	13.48	5.341	59.5
11	22	14.08	5.114	63.0
12	24	14.68	4.906	66.5
13	26	15.27	4.714	70.0
14	28	15.87	4.537	73.5
15	30	16.47	4.372	77.0
16	32	17.07	4.219	80.5

APPENDIX B

Lesson Plans

SESSION: 1

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Participants 3 and 4 did the test together. The other four did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 2

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Participants 3 and 4 did the test together. The other four did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 3

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Participants 3 and 4 did the test together. The other four did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 4

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Participants 3 and 4 did the test together. The other four did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually. The instructor recorded the participants' weights.

SESSION: 5

ACTIVITY

WARM UP: reviewed dance steps: jump and touch heel, side steps, alernating punches
00:00-5:00

AEROBIC DANCE: (music: "Lady You Bring Me Up" by The Commodores)
1. jump and touch heel (5 times)
2. side steps
3. punches alternating right and left fists
4. jump and touch heel (5 times)
5. side steps
6. punches alternating right and left fists
7. jump and touch heel (5 times)
8. side steps
9. jump and touch heel (6 times)
10. side steps
11. punches alternating right and left fists
5:00-9:10

Went to the corner of the room to start running
9:10-10:00

RUNNING (music: "Billie Jean" by Michael Jackson)
10:00-14:57

Stopped to drink water
14:57-15:03

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
15:03-25:00

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
25:00-27:12

COMMENTS and OBSERVATIONS

In order to motivate Participant 1, he was physically prompted by the instuctor while he executed the warm up, the aerobic dance and the walk/jog. The prompting was in the form of holding his hand. The other participants only needed verbal encouragement to perform the movements. Participant 5 seems to have a short attention span.

SESSION: 6

ACTIVITY

WARM UP: reviewed dance steps: jump and touch heel, side steps, alernating punches
0:00-15:00

AEROBIC DANCE: (music:"Lady You Bring Me Up" by The Commodores)
1. jump and touch heel (5 times)
2. side steps
3. punches alternating right and left fists
4. jump and touch heel (5 times)
5. side steps
6. punches alternating right and left fists
7. jump and touch heel (5 times)
8. side steps
9. jump and touch heel (6 times)
10. side steps
11. punches alternating right and left fists

15:00-19:16

Went to the corner of the room to start running
19:16-20:30

RUNNING (music: "Billie Jean" by Michael Jackson)
20:30-25:45

Stopped to drink water
25:45-26:57

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)

One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The

chaser became "it" and the game continued.
26:57-34:00

COMMENTS and OBSERVATIONS

The warm up took 15 minutes long because three classes of students were walking through the gym and the participants became very distracted. There was no cool down this session because the warm up took up too much time. In order to motivate Participant 1, he was physically prompted by the instuctor while he executed the warm up, the aerobic dance and the walk/jog. The prompting was in the form of holding his hand. The other participants only needed verbal encouragement to perform the movements.

SESSION: 7

ACTIVITY

WARM UP: reviewed dance steps: jump and touch heel, side steps, alernating punches
0:00-5:00

AEROBIC DANCE: (music: "Lady You Bring Me Up" by The Commodores)
1. jump and touch heel (5 times)
2. side steps
3. punches alternating right and left fists
4. jump and touch heel (5 times)
5. side steps
6. punches alternating right and left fists
7. jump and touch heel (5 times)
8. side steps
9. jump and touch heel (6 times)
10. side steps
11. punches alternating right and left fists
5:00-9:03

Went to the corner of the room to start running
9:03-10:30

RUNNING (music: "Billie Jean" by Michael Jackson)
10:30-14:35

Stopped to drink water
14:35-15:47

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
15:47-26:00

COOL DOWN
1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
26:00-30:16

COMMENTS and OBSERVATIONS
In order to motivate Participant 1, he was physically prompted by the instuctor while he executed the warm up, the aerobic dance and the walk/jog. The prompting was in the form of holding his hand. The other participants only needed verbal encouragement to perform the movements.

SESSION: 8

ACTIVITY

WARM UP: reviewed dance steps: jump and touch heel, side steps, alernating punches
0:00-4:48

AEROBIC DANCE: (music:"Lady You Bring Me Up" by The Commodores)
1. jump and touch heel (5 times)
2. side steps
3. punches alternating right and left fists
4. jump and touch heel (5 times)
5. side steps
6. punches alternating right and left fists
7. jump and touch heel (5 times)
8. side steps
9. jump and touch heel (6 times)
10. side steps
11. punches alternating right and left fists
4:48-9:12

Went to the corner of the room to start running
9:12-10:20

RUNNING (music: "Thriller" by Michael Jackson)
10:20-16:15

Stopped to drink water
16:15-17:20

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
17:20-25:32

COOL DOWN
1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
25:32-29:41

COMMENTS and OBSERVATIONS
In order to motivate Participant 1, he was physically prompted by the instuctor while he executed the warm up, the aerobic dance and the walk/jog. The prompting was in the form of holding his hand. The other participants only needed verbal encouragement to perform the movements.

SESSION: 9

ACTIVITY

WARM UP: reviewed dance steps: jump and touch heel, side steps, alernating punches
0:00-4:45

AEROBIC DANCE: (music:"Lady You Bring Me Up" by The Commodores)
1. jump and touch heel (5 times)
2. side steps

3. punches alternating right and left fists
4. jump and touch heel (5 times)
5. side steps
6. punches alternating right and left fists
7. jump and touch heel (5 times)
8. side steps
9. jump and touch heel (6 times)
10. side steps
11. punches alternating right and left fists

4:45-9:52

Went to the corner of the room to start running
9:52-10:11

RUNNING (music "Thriller" by Michael Jackson)
10:11-16:34

Stopped to drink water
16:34-17:45

GAME. 'Slap Jack' (adapted from Kirchner, 1981, p 244)

One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.

17:45-25:56

COOL DOWN

1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax

25:56-29:19

COMMENTS and OBSERVATIONS

In order to motivate Participant 1, he was physically prompted by the instuctor while he executed the warm up, the aerobic dance and the walk/jog. The prompting was in the form of holding his hand. The other participants only needed verbal encouragement to perform the movements.

SESSION: 10

ACTIVITY

WARM UP: reviewed dance steps: jump and toudh heel, side steps, alernating punches
0:00-2.29

AEROBIC DANCE: (music:"Lady You Bring Me Up" by The Commodores)

1	jump and touch heel (5 times)	2:29-3:04
2.	side steps	3:04-3:17
3	punches alternating right and left fists	3:17-3:39
4	jump and touch heel (5 times)	3:39-3:56
5	side steps	3:56-4:19
6	punches alternating right and left fists	4:19-4:27
7	jump and touch heel (5 times)	4:27-4:43
8	side steps	4:43-5:04
9	jump and touch heel (6 times)	5:04-5:27
10.	side steps	5:27-5:49
11.	punches alternating right and left fists	5:49-6:12

Went to the corner of the room to start running
6.12-7.12

RUNNING (music Thriller by Michael Jackson)
7:12-12 58

Stopped to drink water
12:58-14:27

GAME. "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
14:27-22:56

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles
2 hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
22:56-26:19

COMMENTS and OBSERVATIONS

In order to motivate Participant 1, he was physically prompted by the instuctor while he executed the warm up, the aerobic dance and the walk/jog. The prompting was in the form of holding his hand. The other participants only needed verbal encouragement to perform the movements. Participant 3 wore the Sport Tester. Participant 6 spent three minutes of the game time in the washroom.

SESSION: 11

ACTIVITY	
WARM UP. reviewed dance steps: jump and touch heel, side steps, alernating punches	0.00-3 39
AEROBIC DANCE. (music: "Lady You Bring Me Up" by The Commodores)	
1 jump and touch heel (5 times)	3.39-4:14
2 side steps	4.14-4:27
3 punches alternating right and left fists	4.27-4:49
4 jump and touch heel (5 times)	4·49-5:06
5 side steps	5·06-5:29
6 punches alternating right and left fists	5:29-5:37
7 jump and touch heel (5 times)	5:37-5:53
8 side steps	5:53-6:14
9 jump and touch heel (6 times)	6:14-6:37
10. side steps	6:37-6:59
11. punches alternating right and left fists	6:59-7:22
Went to the corner of the room to start running	7:22-8:34
RUNNING (music: "Thriller" by Michael Jackson)	8:34-14:10
Stopped to drink water	14:10-15:26

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)

One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.

15:26-22:35

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4 curl up and relax
22:35-27:00

COMMENTS and OBSERVATIONS

Participant 1 had to be motivated by holding the instructor's hand during the warm up, dance and periodically during the running segment of the program. Participant 6 refused to wear the Sport Tester. Participants 1, 2 and 4 wore the Sport Tester.

SESSION. 12

ACTIVITY

WARM UP: reviewed dance steps: jump and touch heel, side steps, alernating punches
0 00-2:32

AEROBIC DANCE. (music "Lady You Bring Me Up" by The Commodores)

1 jump and touch heel (5 times)	2:32-3:05
2. side steps	3:05-3:20
3. punches alternating right and left fists	3:20-3:31
4. jump and touch heel (5 times)	3:31-3:53
5. side steps	3:53-4:07
6. punches alternating right and left fists	4:07-4:23
7. jump and touch heel (5 times)	4:23-4:40
8. side steps	4:40-5:03
9. jump and touch heel (6 times)	5:03-5:19
10. side steps	5:19-5:41
11. punches alternating right and left fists	5:41-6:13

Went to the corner of the room to start running
6:13-7:35

RUNNING (music: "Thriller" by Michael Jackson)
7:35-12:49

Stopped to drink water
12:49-15:36

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
15:36-24:51

COMMENTS and OBSERVATIONS

The participants arrived at school late, therefore the program was shortened and the cool down was omitted. Participant 2 was absent. Participants 4 and 5 wore the Sport Tester. Participant 1 was motivated by holding the instructor's hand during the warm up, dance and running segments. Participant 6 performed the dance with intensity, but walked during the running and during the game activity. Participant 5 walked during the running segment.

SESSION: 13

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Participant 2 was absent. Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3 and 4 did the test together. The other three did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 14

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Participants 1 and 4 were absent, so the training program was cancelled. Because participant 2 had been absent the previous session, he did the test this session wearing the Sport Tester. He was physically prompted by holding the instructor's hand while running.

SESSION 15

ACTIVITY

WARM UP: (music:"The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-1:35

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
1:35-5:27

AEROBIC DANCE: (music:"Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place
2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym

5. Repeat steps 1 to 4
6. Repeat steps 1 to 2
5:27-9:30

Went to the corner of the room to start running.

RUNNING (music: "Thriller" by Michael Jackson)
9:30-15:33

Stopped to drink water
15:33-18:00

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
18:00-26:33

COOL DOWN:
1 sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3 hurdle stretch on left leg
4. curl up and relax
26:33-30:37

COMMENTS and OBSERVATIONS
Participants 3 and 4 wore the Sport Tester. Participant 3 showed some anxiety during the first few seconds while wearing the Sport Tester, but then relaxed. Participant 6 did the running segment with minimal intensity. Participant 1 was motivated by holding the instructor's hand during three quarters of the running segment.

SESSION: 16

ACTIVITY

WARM UP: (music: "The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-1:42

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2 jog to left/right and repeat
3 jog into center/out and repeat
4 link arms with partner and jog then repeat
5. Repeat steps 2 to 4
1 42-5:38

AEROBIC DANCE: (music: "Uptown Girl" by Billy Joel)
Circle formation holding hands
1 jog in place
2 jog to left/right and repeat
3 kick into center of circle
4. jog holding hands moving around the gym
5 Repeat steps 1, 2 and 4
5:38-9:28

Went to the corner of the room to start running.
9:28-10:30

RUNNING (music: "Thriller" by Michael Jackson)
10:30-15:44

Stopped to drink water
15:44-17:32

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
17:32-25:48

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles

2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
25:48-29:54

COMMENTS and OBSERVATIONS

Participants 1 and 2 wore the Sport Tester. Participant 6 performed the warm up and aerobic dance with intensity but then slowed down considerably during the running and the game. Participant 5 walked during the running segment. Participant 1 was motivated by holding the instructor's hand during three quarters of the running segment.

SESSION: 17

ACTIVITY

WARM UP: (music "The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-1:38

AEROBIC DANCE: (music. Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
1:38-5:37

AEROBIC DANCE: (music:"Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place
2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
5:37-8:34

Went to the corner of the room to start running.
8:34-9:12

RUNNING (music: "Thriller" by Michael Jackson)

9:12-14:57

Stopped to drink water
14:57-17:05

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
17:05-25:51

COOL DOWN:
1 curl up and relax
25:51-27:00

COMMENTS and OBSERVATIONS
The gym was needed for the lunch hour, therefore the program was shortened and the stretching was omitted. Participant 5 wore the Sport Tester. Participant 6 did not partake in the game for approximately five minutes. Participant 2 moved continuously throughout the session but with a low intensity Participant 1 was motivated by holding the instructor's hand during three quarters of the running segment

SESSION: 18

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3 and 4 did the test together. The other three did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 19

ACTIVITY

WARM UP: (music: "The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-1:26

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
1:26-4:37

AEROBIC DANCE: (music: "Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place
2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
6. Repeat steps 1 to 4
4:37-7:37

Went to the corner of the room to start running.
7:37-8:49

RUNNING (music: "Thriller" by Michael Jackson)
8:49-14:23

Stopped to drink water
14:23-16:40

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag ~~him~~ before he returned to the empty space. The chaser became "it" and the game continued.
16:40-26:38

COOL DOWN:

1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax

26:38-29:20

COMMENTS and OBSERVATIONS

Participants 3 and 4 wore the Sport Tester. Participant 5 played the game with a high intensity. Participant 1 was motivated by holding the instructor's hand during three quarters of the running segment.

SESSION. 20

ACTIVITY

WARM UP: (music: "The Saints Go Marching In" by Traditional)
1 arm rotations
2 marching
3. arm rotations with marching
0:00-1:09

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
1:09-4:11

AEROBIC DANCE: (music: "Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place
2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
6. Repeat steps 1 to 4
4:11-7:08

Went to the corner of the room to start running.
7:08-8:07

RUNNING (music: "Thriller" by Michael Jackson)

8:07-13:03

Stopped to drink water
13:03-16:01

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
16:01-23:20

COMMENTS and OBSERVATIONS

The gym was needed for the lunch hour, therefore the program was shortened and the cool down was omitted. Participants 1 and 2 wore the Sport Tester. The heart rates were not monitored properly for participant 1 because he consistently touched the transmitter. All of the participants seemed very enthusiastic during the session and were moving continuously with intensity.

SESSION: 21

ACTIVITY

WARM UP: (music: "The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-1:29

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
1:29-5:59

AEROBIC DANCE: (music: "Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place

2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
6. Repeat steps 1 to 4
5:59-9:01

Went to the corner of the room to start running.
9:01-10:25

RUNNING (music: "Thriller" by Michael Jackson)
10:25-15:23

Stopped to drink water
15:23-18:19

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)

One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
18:19-27:40

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
27:40-30:12

COMMENTS and OBSERVATIONS

Participants 1 and 5 wore the Sport Tester. Participant 5 played the game with a high intensity. Participant 4 refused to execute the program and sat on the bench. As a group, the participants were agitated and it was difficult to keep their attention. Because of their behavior, more time than usual was spent in organizing them into circle formations for the dances and the game. During the running segment, participant 1 held the instructor's hand for three quarters of the running time, and participant 6 jogged for half of the segment and walked during the remaining time.

SESSION: 22

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3 and 4 did the test together The other three did the test individually with prompting from the instructor The prompting for participants 1, 2 and 5 was physical To be specific, they held the instructor s hand. Participant 6 was prompted verbally and visually

SESSION. 23

ACTIVITY

WARM UP: (music:"The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-1:31

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
1:31-5:46

AEROBIC DANCE: (music:"Uptown Girl" by Billy Joel)

Circle formation holding hands
1. jog in place
2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
6. Repeat steps 1 to 4
5:46-8:52

Went to the corner of the room to start running
8:52-10:31

RUNNING (music: "Beat It" and "Billie Jean" by Michael Jackson) 10:31-19:21

Stopped to drink water
19:21-21:30

GAME: "Slap Jack" (adapted from Kirchner, 1981, p 244)
One Participant was chosen to be 'it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It' walked around the circle and slapped a player on the hands This player chased "it' around the circle and tried to tag him before he returned to the empty space The chaser became 'it and the game continued
21:30-28:39

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles
2 hurdle stretch on right leg
3. hurdle stretch on left leg
4 curl up and relax
28:39-32:10

COMMENTS and OBSERVATIONS
Participant 2 wore the Sport Tester Participant 5 moved more continuously this session and ran with high intensity during the game. Participant 6 played the game for approximately three minutes then spent the reminader of the time in the washroom. During the running segment, participant 1 held the instructor's hand for three quarters of the time

SESSION: 24

ACTIVITY

WARM UP: (music:"The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-3:16

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
3.16-6:45

AEROBIC DANCE: (music."Uptown Girl" by Billy Joel)
Circle formation holding hands
1 jog in place
2 jog to left/right and repeat
3 kick into center of circle
4 jog holding hands moving around the gym
5 Repeat steps 1 to 4
6 Repeat steps 1 to 4
6·45-10:04

Went to the corner of the room to start running.
10:04-11:34

RUNNING (music: "Beat It" and "Billie Jean" by Michael Jackson) 11:34-20:30

Stopped to drink water
20:30-22:30

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
22:30-28:10

COOL DOWN:

1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
28:10-31:10

COMMENTS and OBSERVATIONS

Participants 1 and 5 wore the Sport Tester. Participant 5 moved continuously during the warm up and dances, but intermittently during the running segment. Participant 6 was in the washroom for one minute of the game time. During the running segment, participant 1 held the instructor s hand for three quarters of the time.

SESSION 25

ACTIVITY

WARM UP (music: The Saints Go Marching In by Traditional)
1 arm rotations
2 marching
3 arm rotations with marching
0 00-2:09

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1 walk to left/right and repeat
2. jog to left/right and repeat
3 jog into center/out and repeat
4. link arms with partner and jog then repeat
5 Repeat steps 2 to 4
6. Repeat steps 2 to 4
2:09-5:20

AEROBIC DANCE: (music:"Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place
2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
6. Repeat steps 1 to 4
5:20-8:07

Went to the corner of the room to start running.
8:07-9:30

RUNNING (music: "Beat It" and "Billie Jean" by Michael Jackson) 9:30-18:14

Stopped to drink water
18:14-20:30

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands. This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
20:30-26:30

COMMENTS and OBSERVATIONS
Because the gym was needed for the lunch hour, the session was shortened and therefore the stretching segmeted was omitted Participants 3 and 4 wore the Sport Tester. Participant 1 held the instructor's hand during three quarters of the running segment.

SESSION: 26

ACTIVITY

WARM UP: (music:"The Saints Go Marching In" by Traditional)
1. arm rotations
2. marching
3. arm rotations with marching
0:00-3:00

AEROBIC DANCE: (music: Folk-raft F1331 Polka)
Circle formation holding hands
1. walk to left/right and repeat
2. jog to left/right and repeat
3. jog into center/out and repeat
4. link arms with partner and jog then repeat
5. Repeat steps 2 to 4
6. Repeat steps 2 to 4
3:00-6:15

AEROBIC DANCE: (music:"Uptown Girl" by Billy Joel)
Circle formation holding hands
1. jog in place

2. jog to left/right and repeat
3. kick into center of circle
4. jog holding hands moving around the gym
5. Repeat steps 1 to 4
6. Repeat steps 1 to 4
6:15-9:20

Went to the corner of the room to start running.
9:20-10:20

RUNNING (music: "Beat It" and "Billie Jean" by Michael Jackson) 10:20-18:50

Stopped to drink water
18:50-20:20

GAME: "Slap Jack" (adapted from Kirchner, 1981, p.244)
One Participant was chosen to be "it" and stood outside the circle of players. Circle players faced the center, with hands together, palms up, behind their backs. "It" walked around the circle and slapped a player on the hands This player chased "it" around the circle and tried to tag him before he returned to the empty space. The chaser became "it" and the game continued.
20 20-25·50

COOL DOWN:
1. sitting down with legs extended in front and reaching for ankles
2. hurdle stretch on right leg
3. hurdle stretch on left leg
4. curl up and relax
25:50-29:15

COMMENTS and OBSERVATIONS
Participant 1 held the instructor's hand during three quarters of the running segment.

SESSION: 27

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3

and 4 did the test together. The other three did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 28

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3 and 4 did the test together The other three did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

SESSION: 29

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3 and 4 did the test together. The other three did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor s hand Participant 6 was prompted verbally and visually

SESSION. 30

LEGER SHUTTLE RUN TEST

COMMENTS and OBSERVATIONS

Heart rates were monitored with the Sport Tester on all participants except for participant 6. Participants 3 and 4 did the test together. The other three did the test individually with prompting from the instructor. The prompting for participants 1, 2 and 5 was physical. To be specific, they held the instructor's hand. Participant 6 was prompted verbally and visually.

APPENDIX C

Heart Rate Response to the Endurance Program

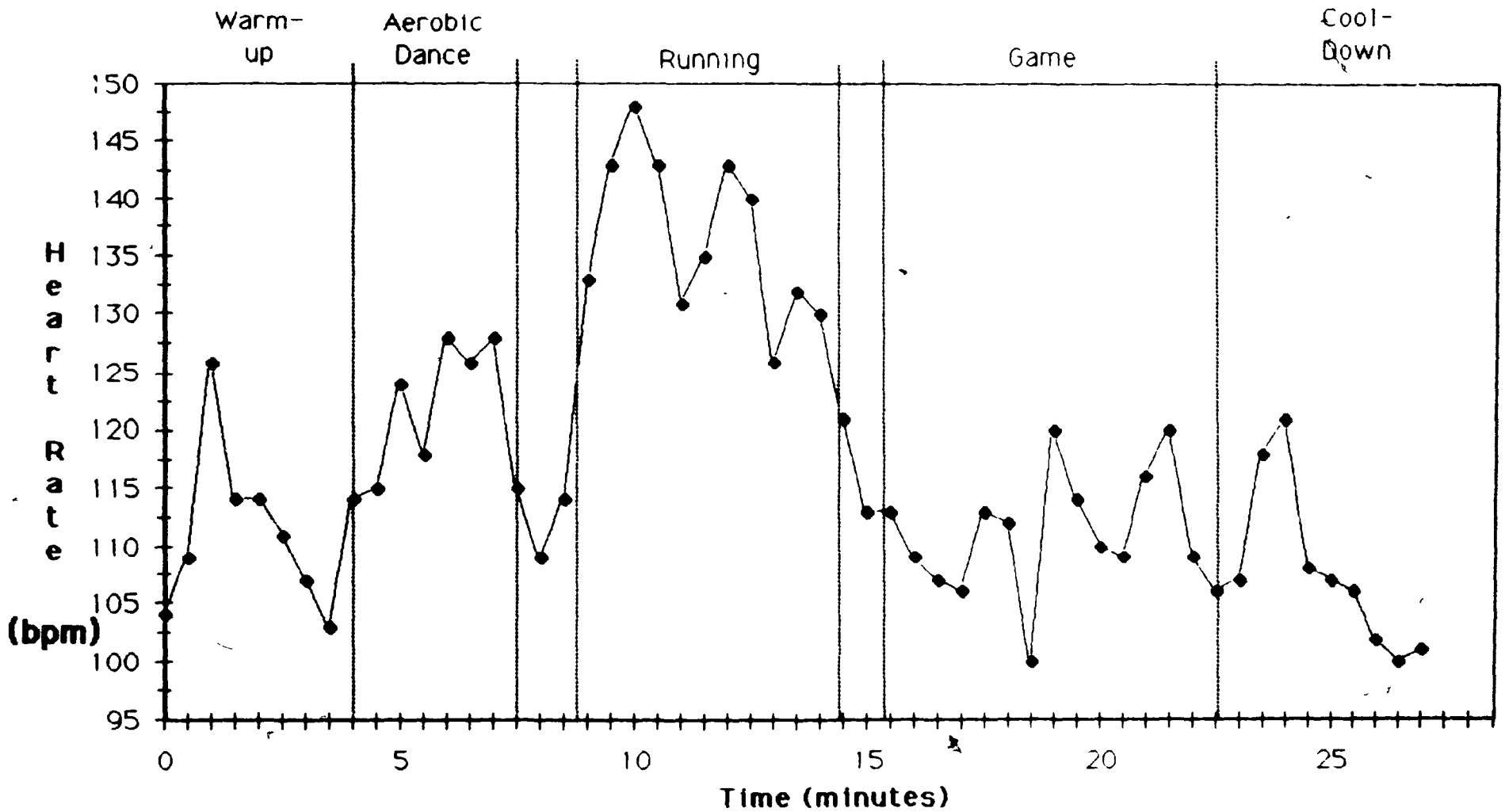

Figure 8 Heart Rate Response of Participant 1 During Session #11

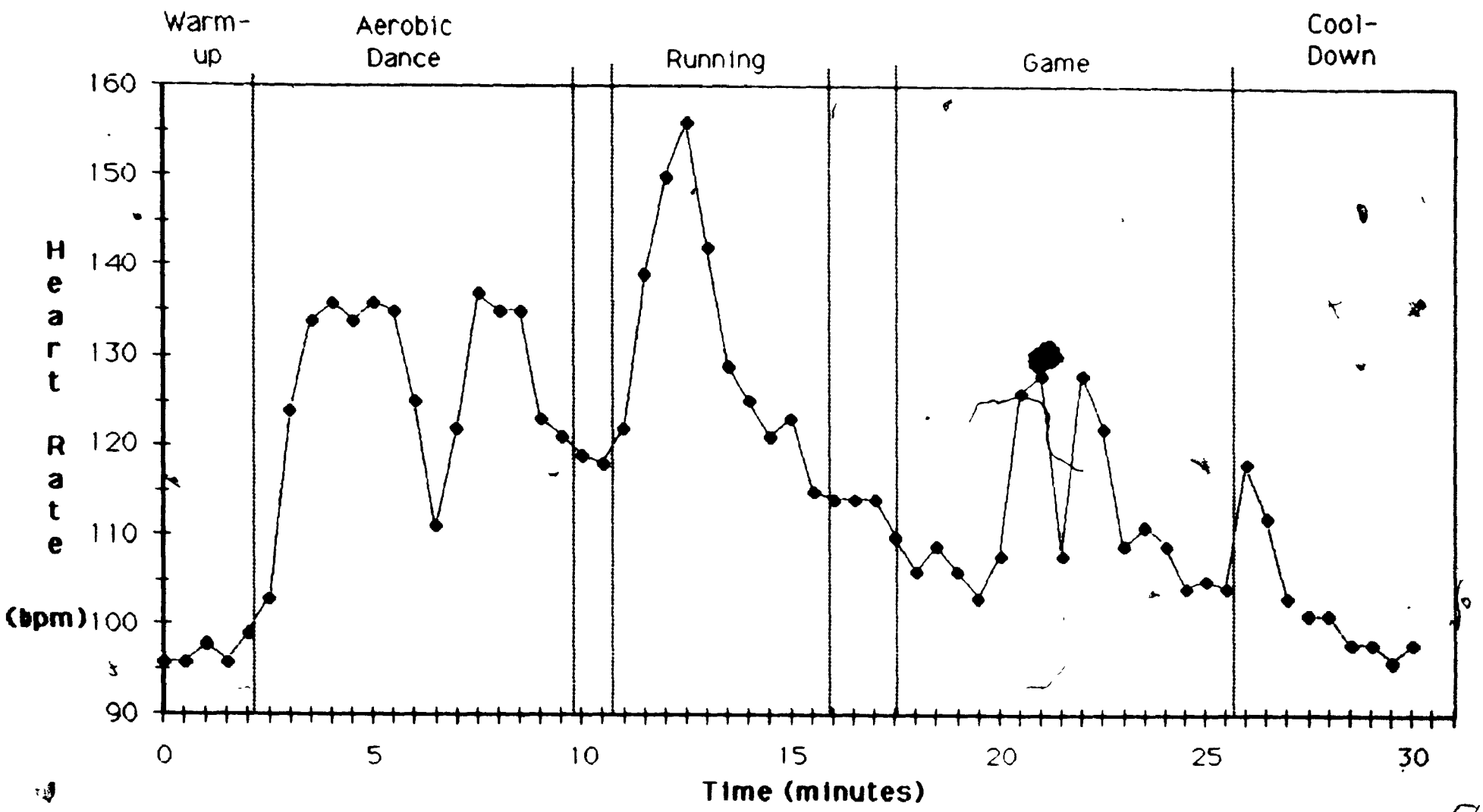

Figure 9 Heart Rate Response of Participant 1 During Session #16

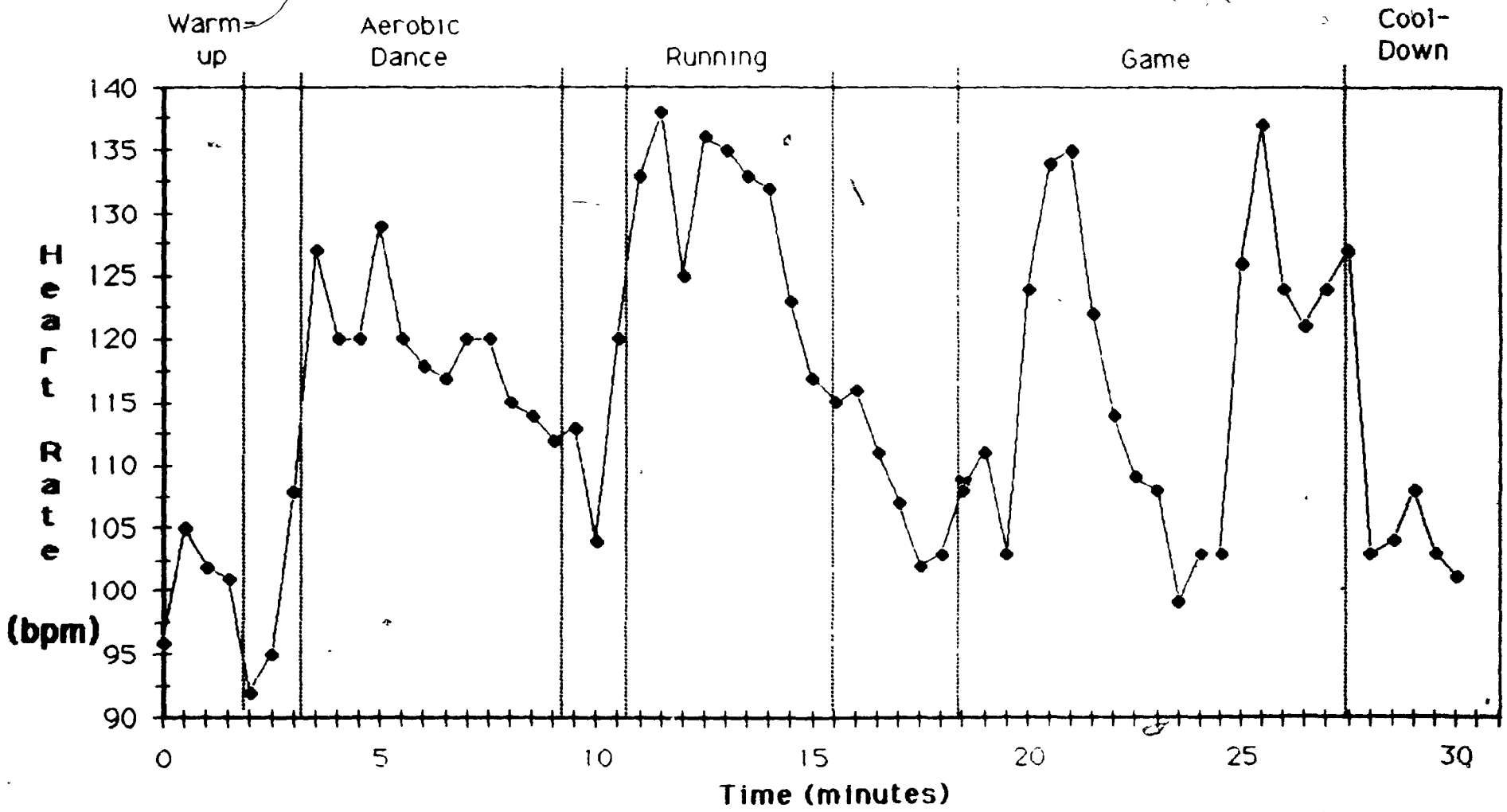

Figure 10 Heart Rate Response of Participant 1 During Session #21

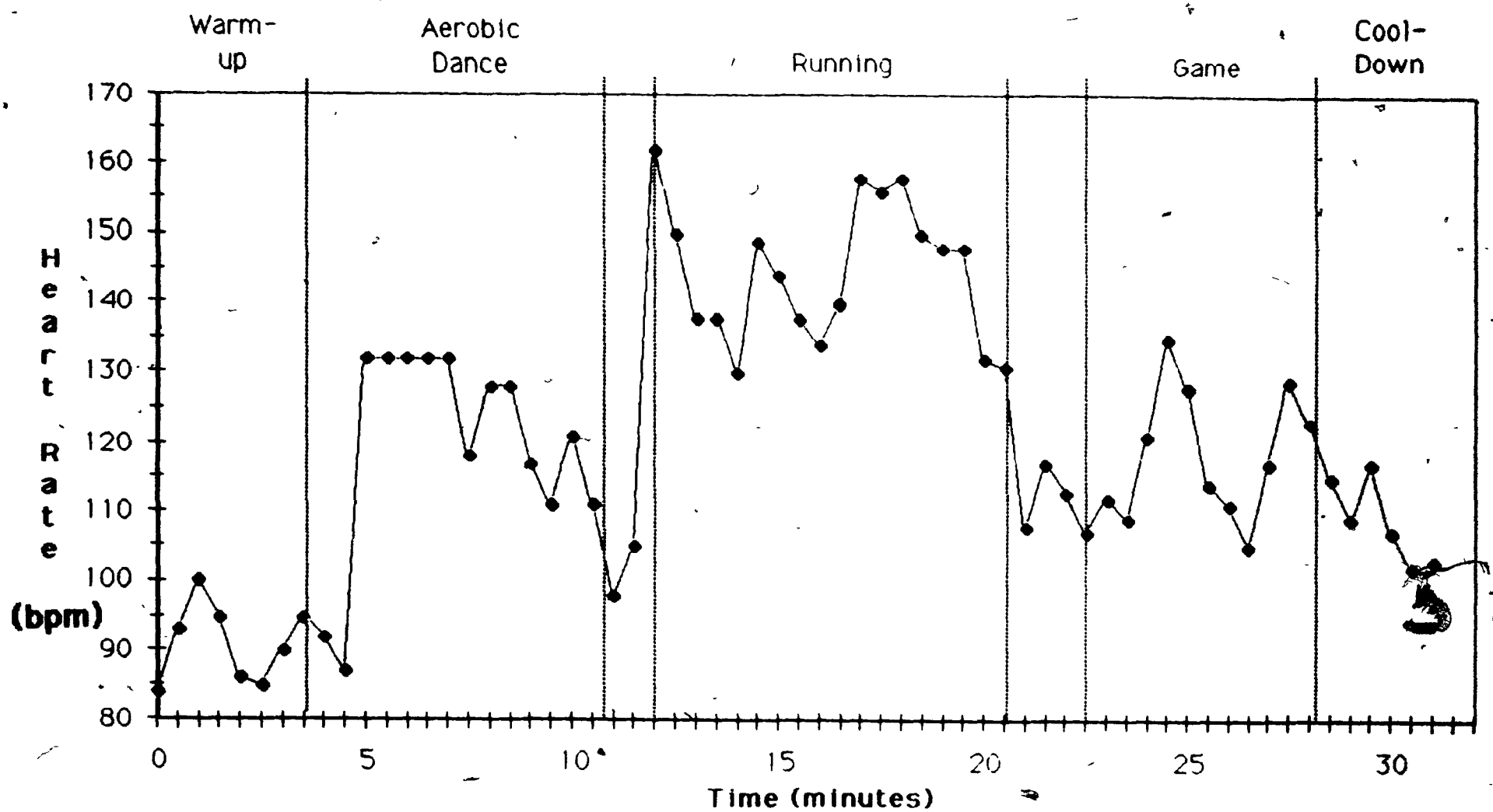

Figure 11 Heart Rate Response of Participant 1 During Session #24

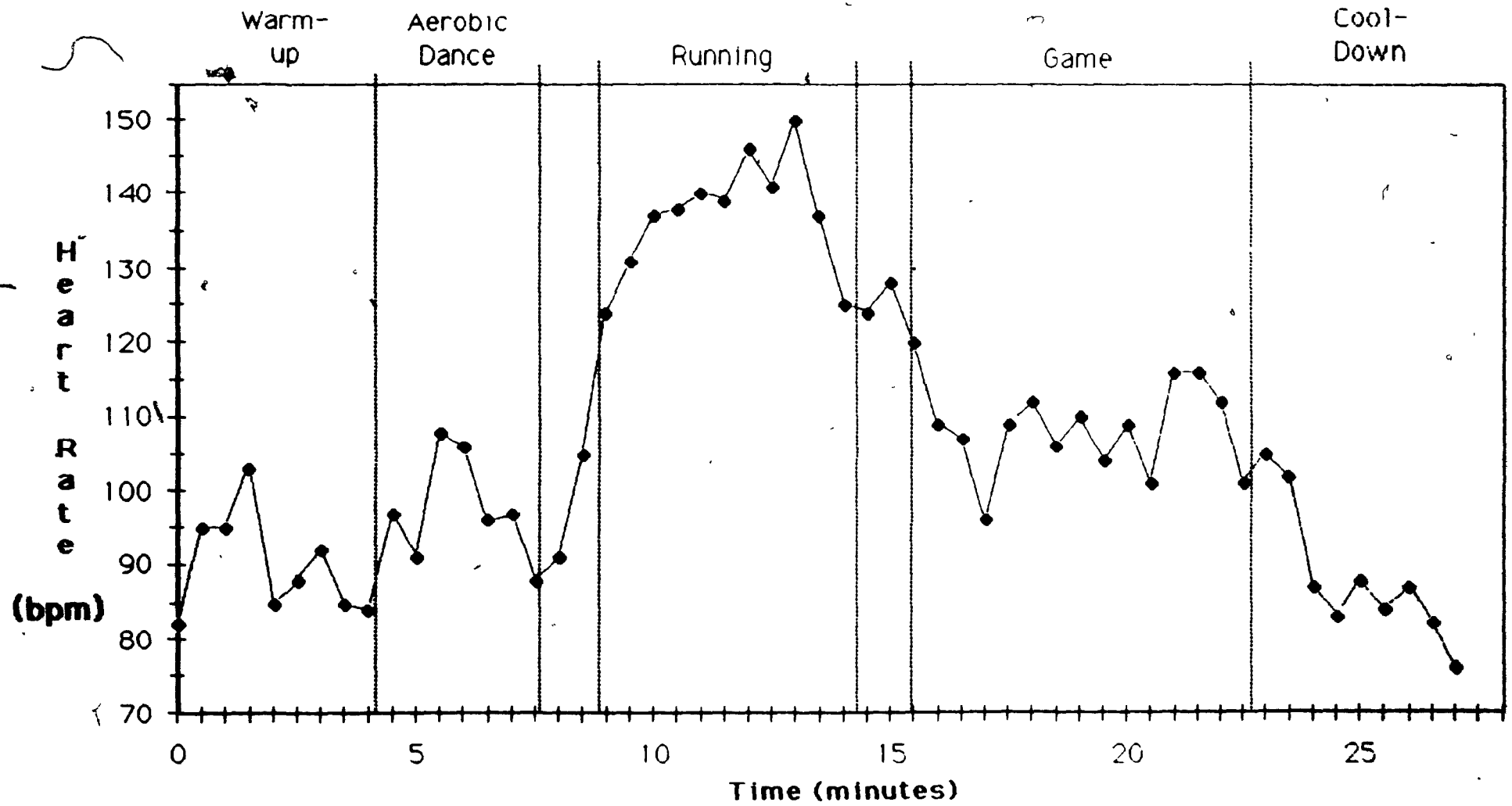

Figure 12 Heart Rate Response of Participant 2 During Session #11

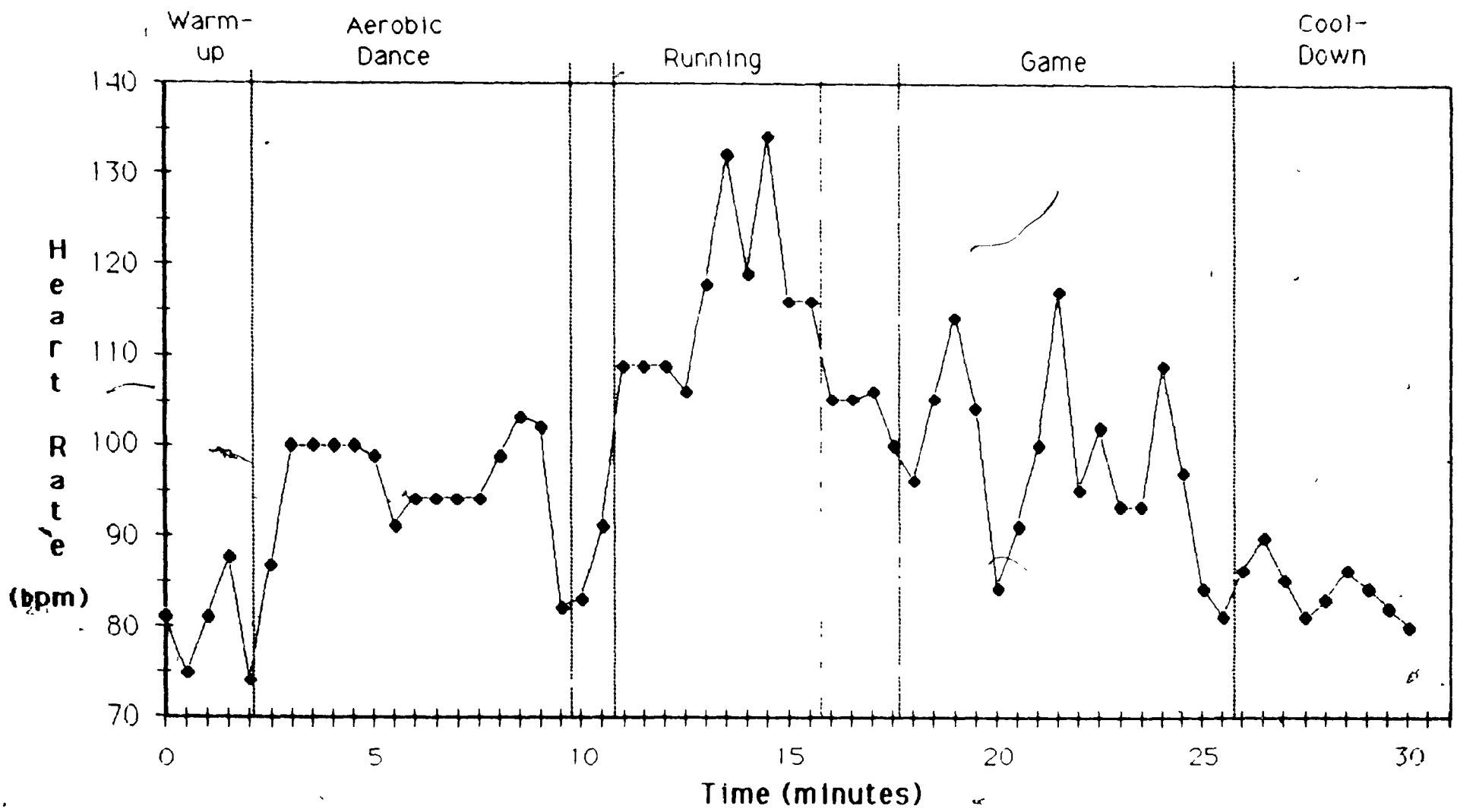

Figure 13 Heart Rate Response of Participant 2 During Session #16

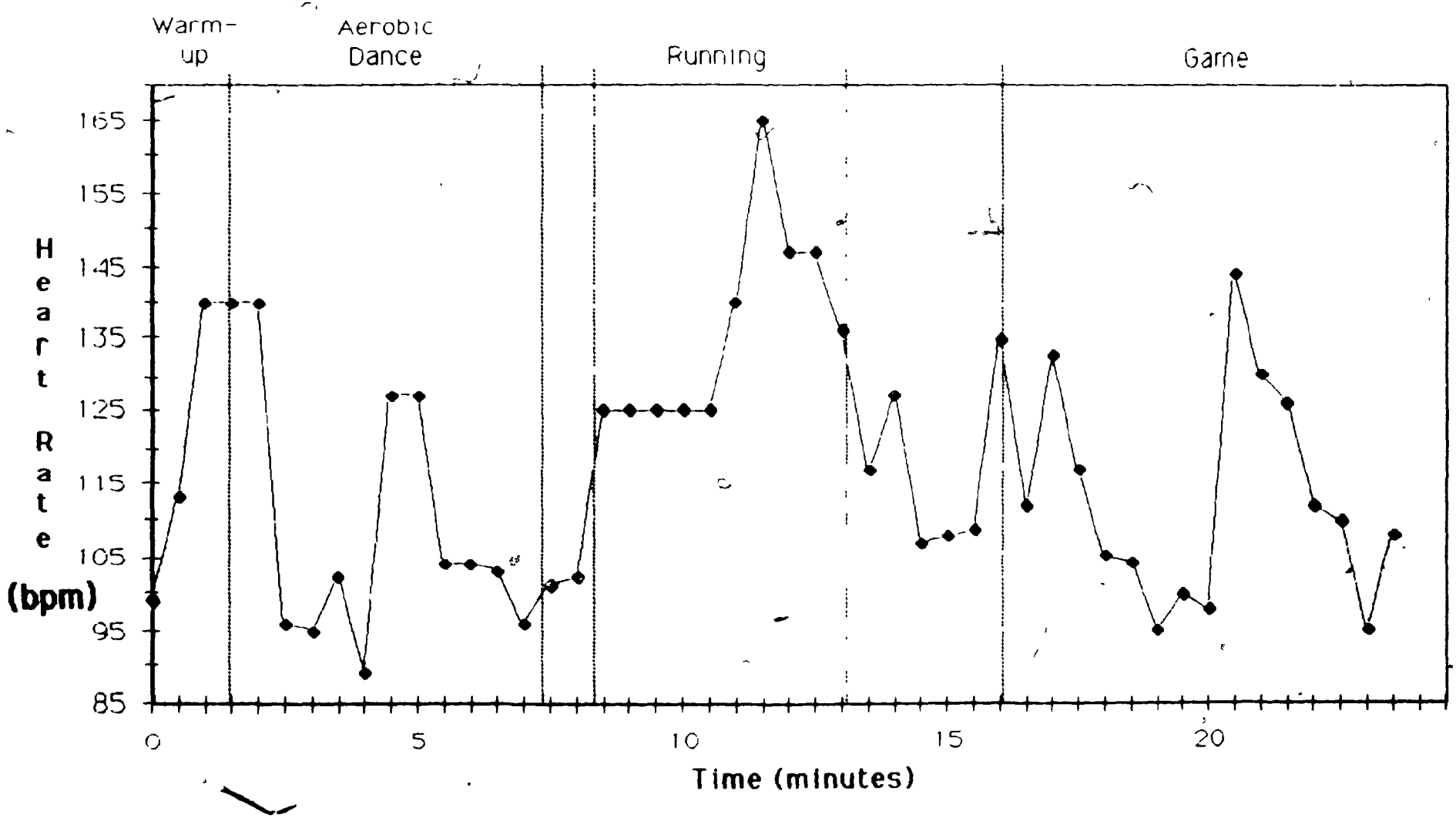

Figure 14 Heart Rate Response of Participant 2 During Session #20

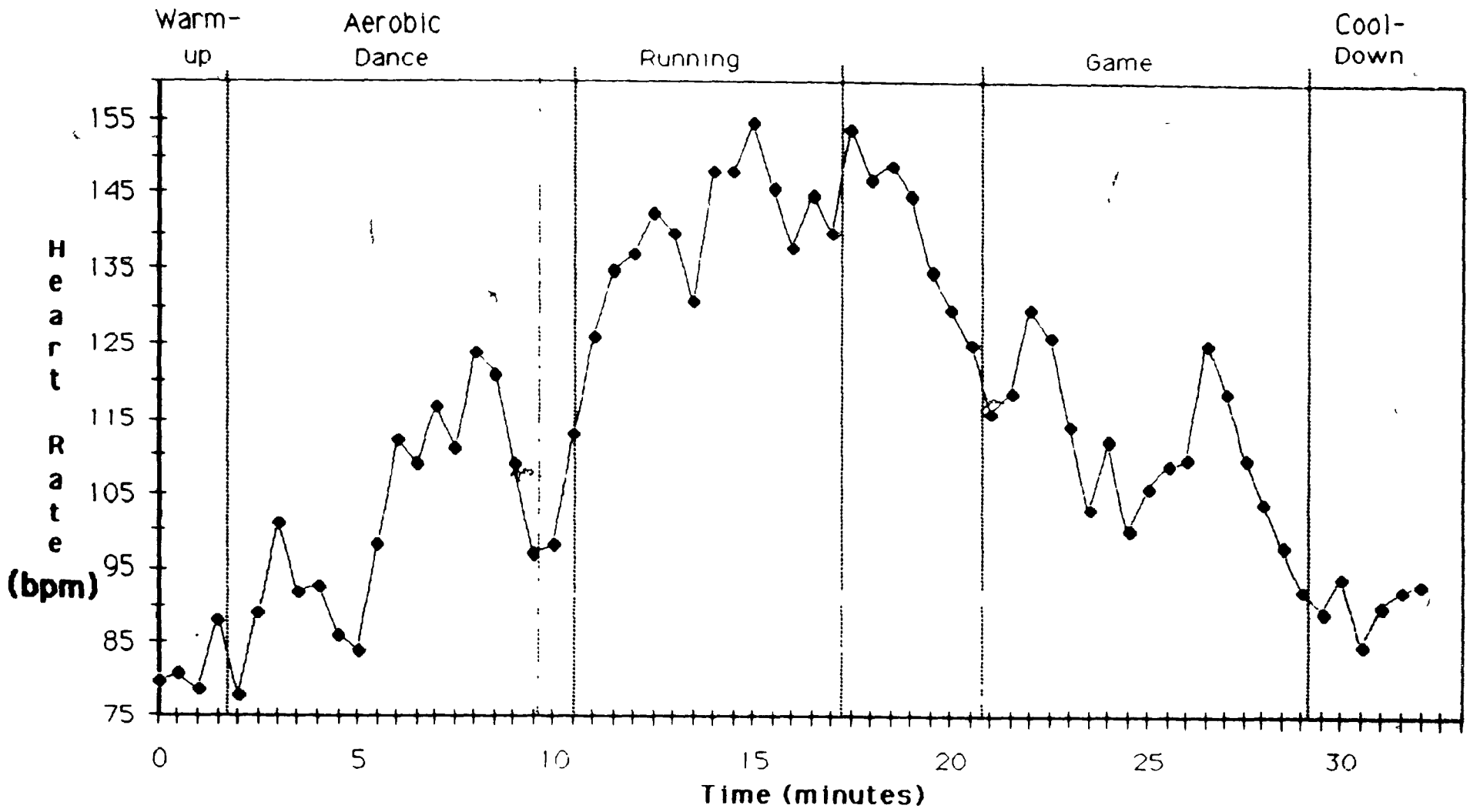

Figure 15 Heart Rate Response of Participant 2 During Session #23

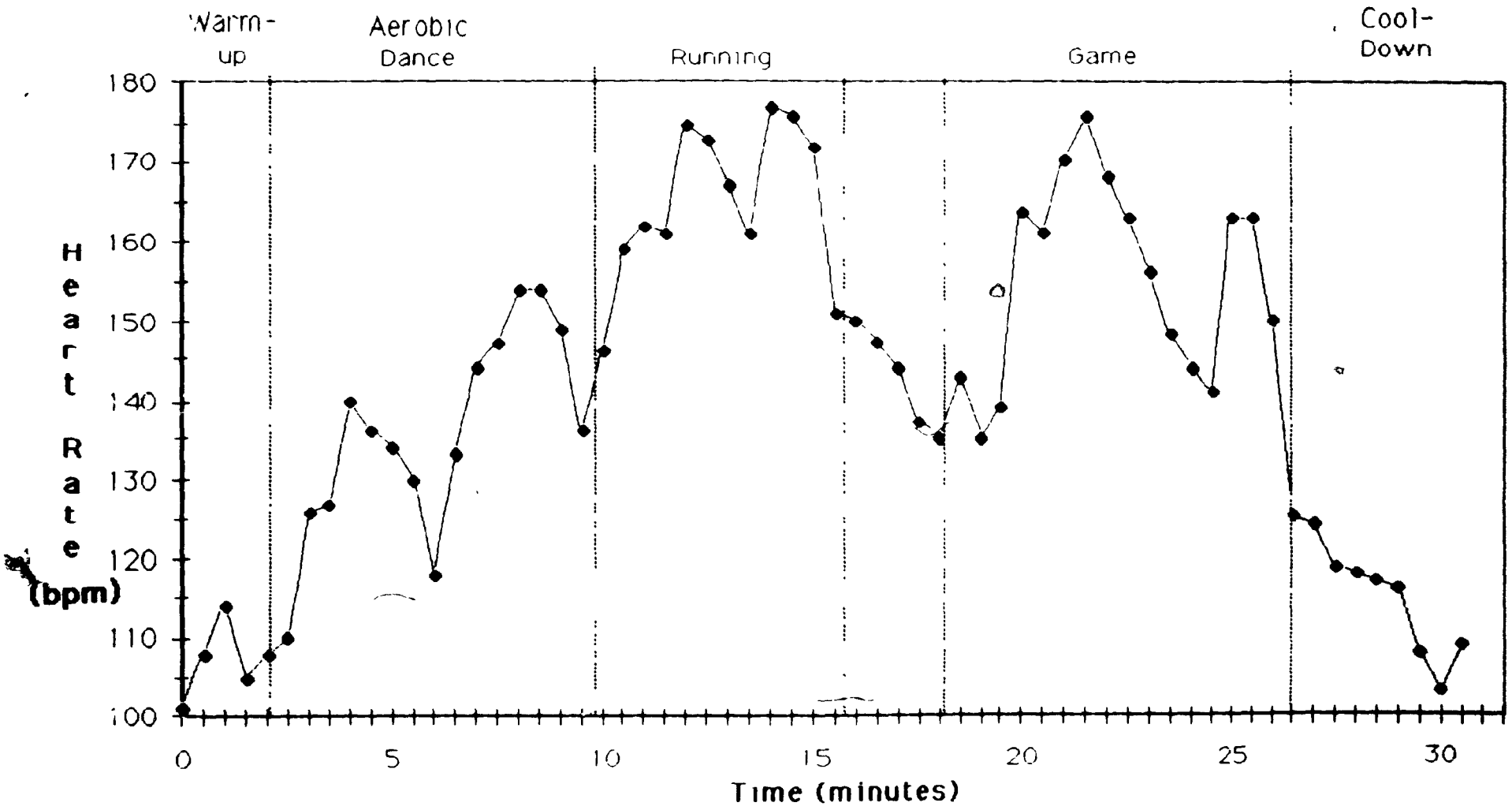

Figure 16 Heart Rate Response of Participant 3 During Session #15

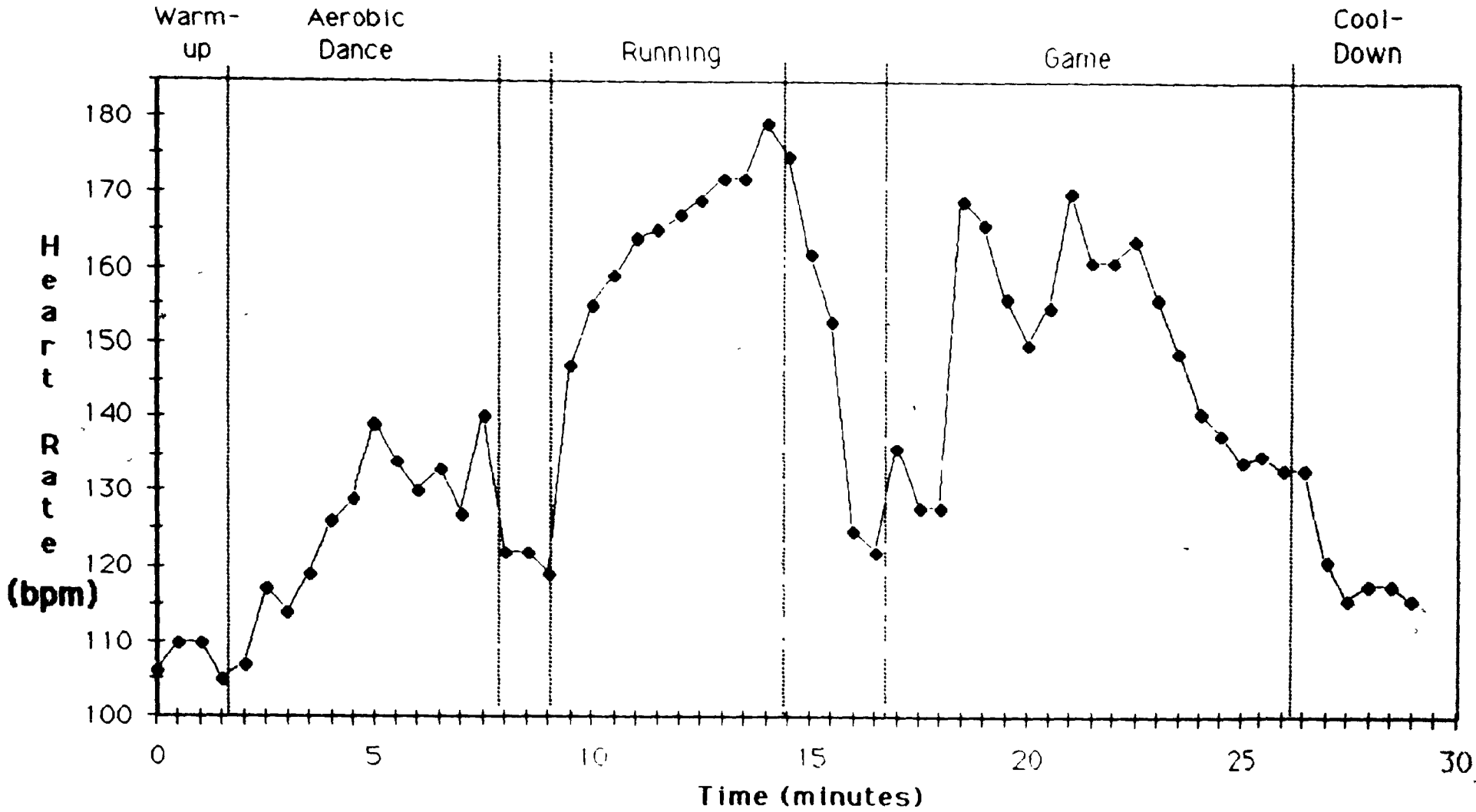

Figure 17. Heart Rate Response of Participant 3 During Session #19

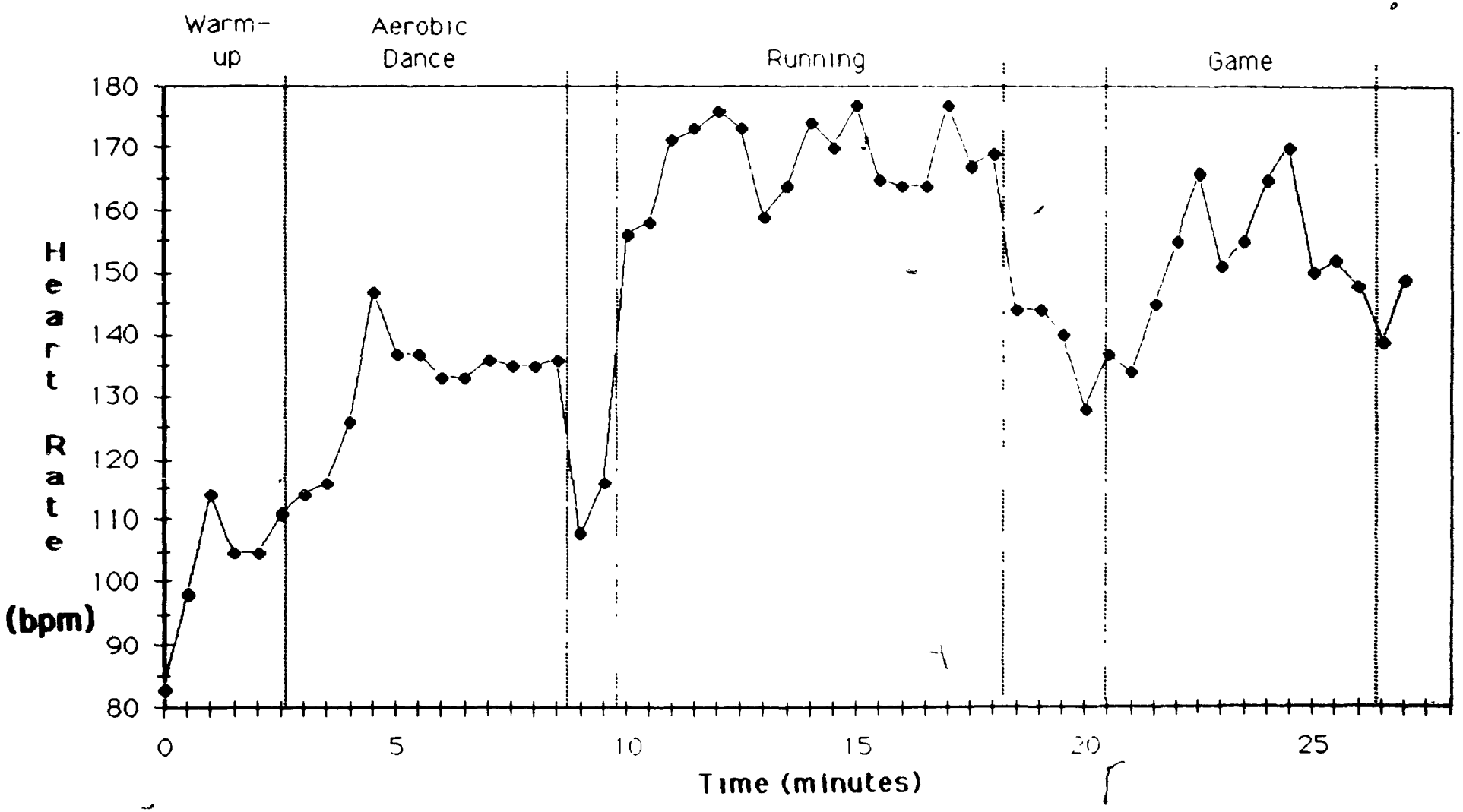

Figure 18 Heart Rate Response of Participant 3 During Session #25

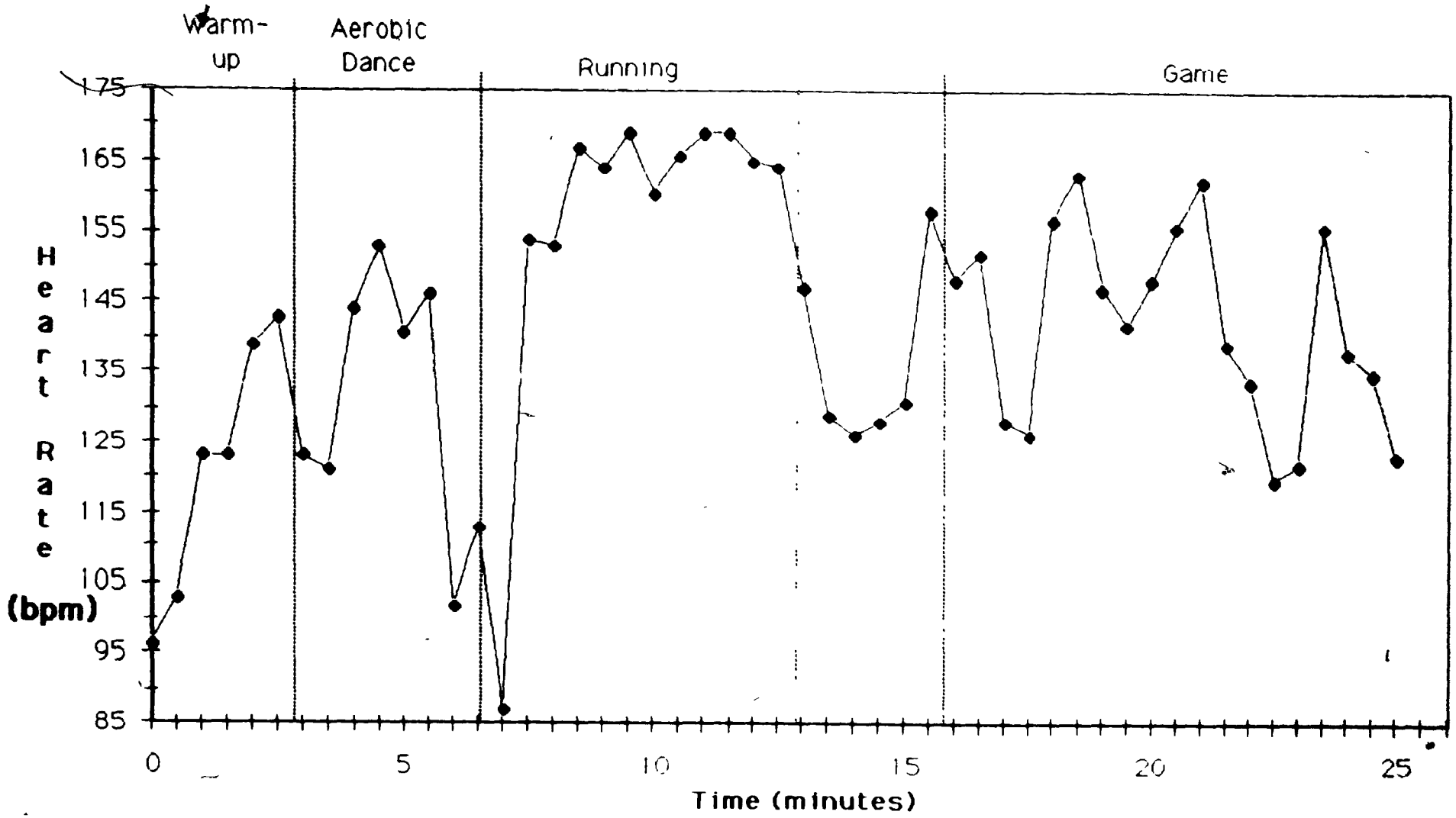

Figure 19 Heart Rate Response of Participant 4 During Session #12

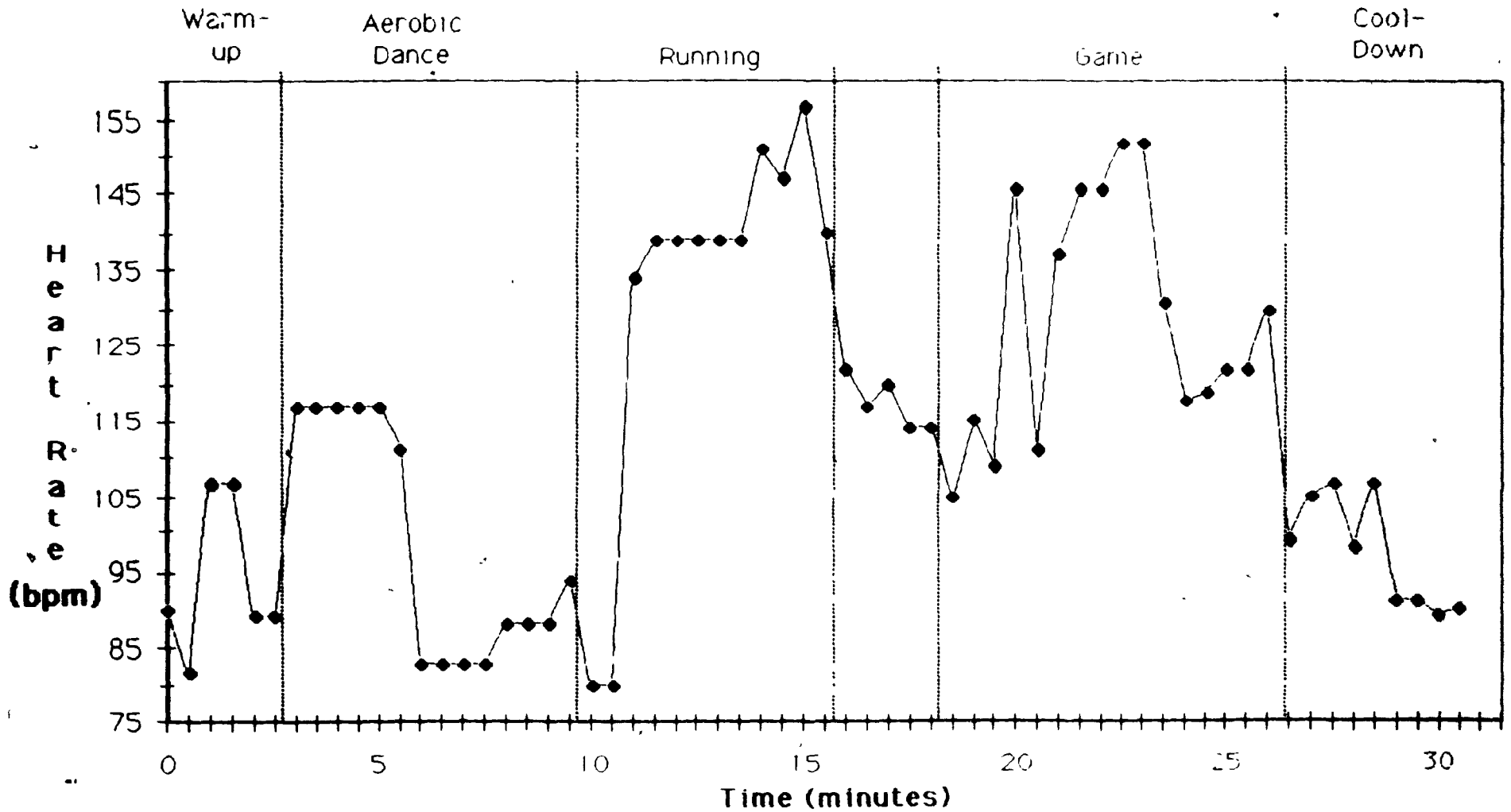

Figure 20 Heart Rate Response of Participant 4 During Session #15

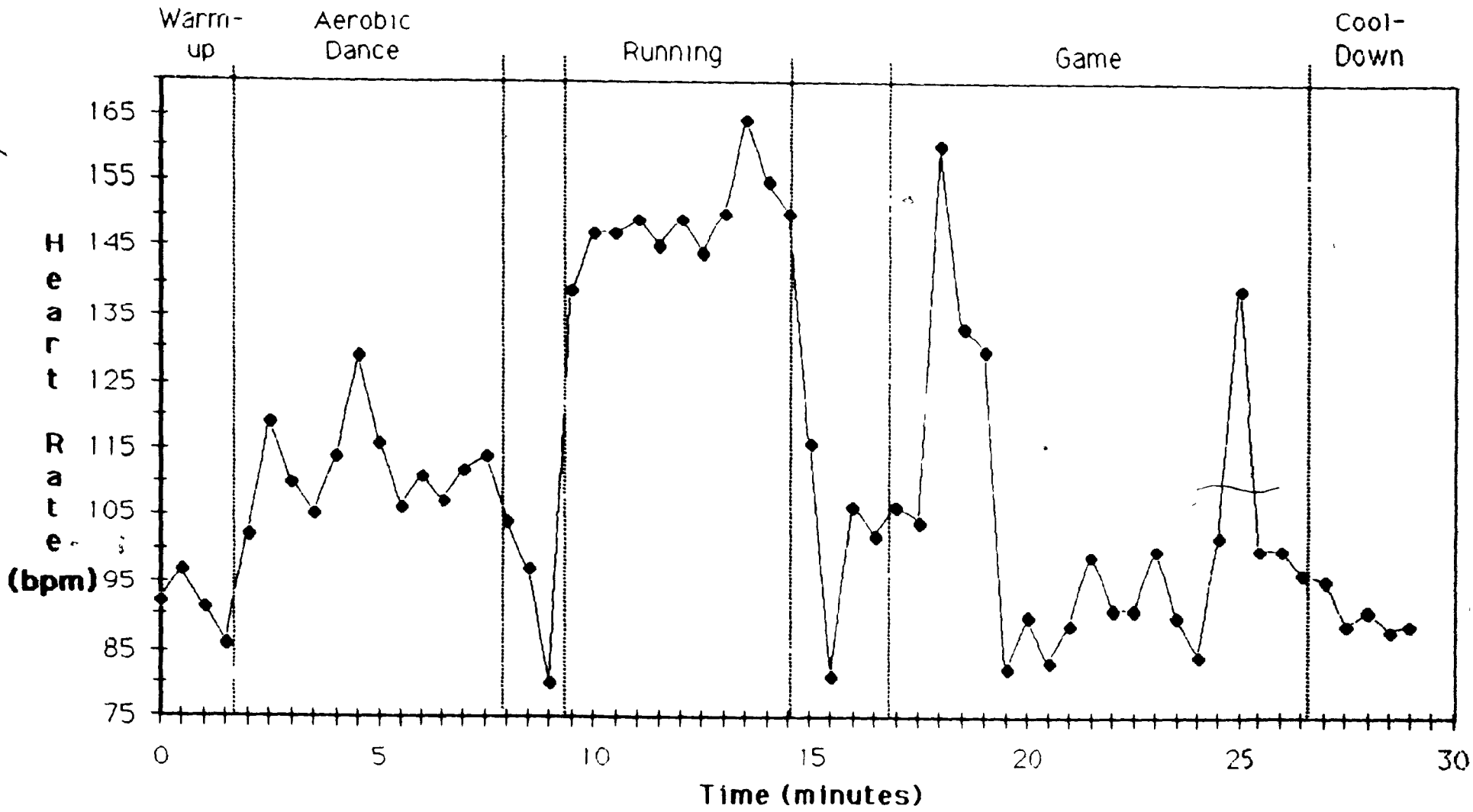

Figure 21 Heart Rate Response of Participant 4 During Session #19

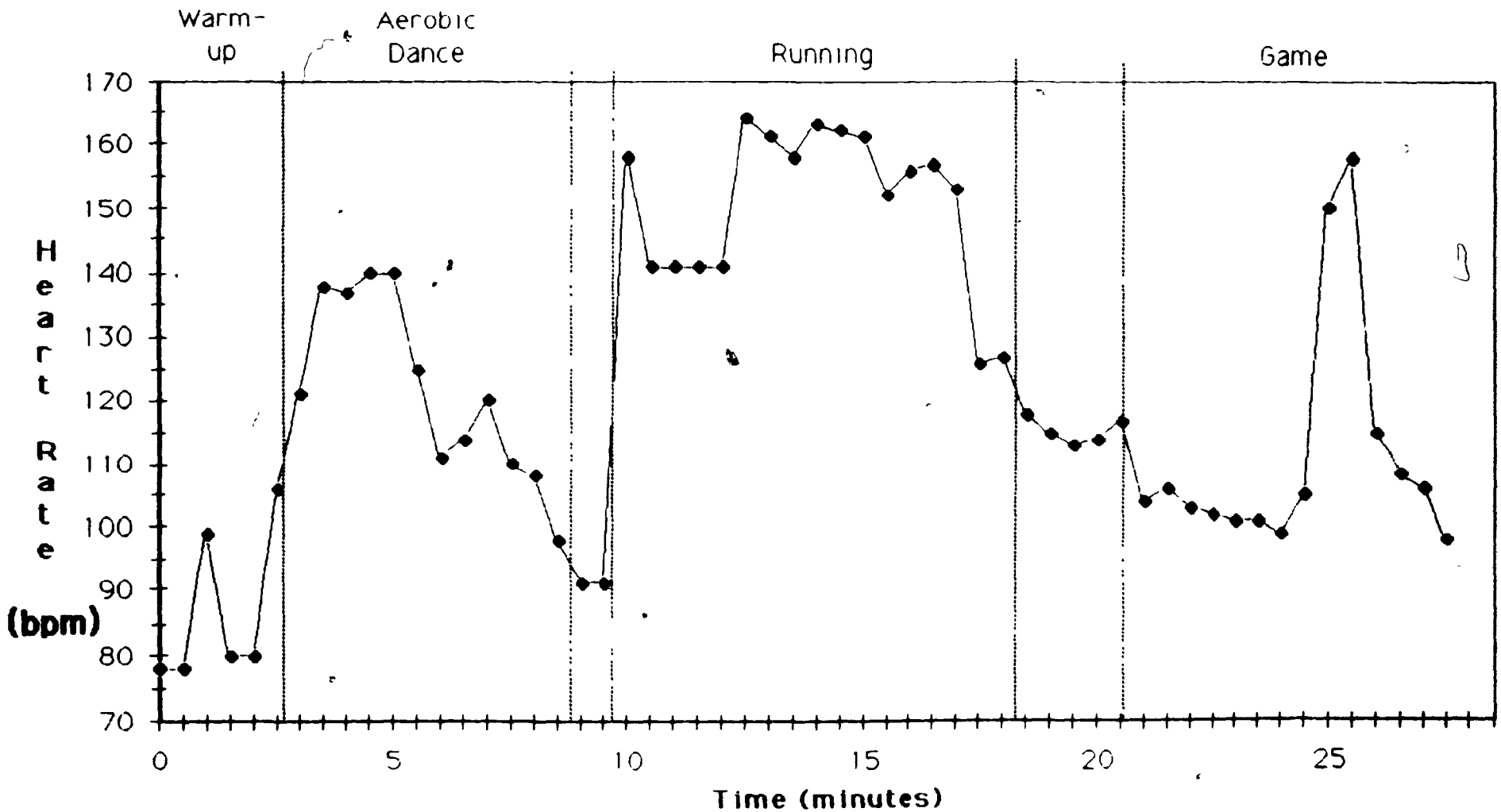

Figure 22 Heart Rate Response of Participant 4 During Session #25

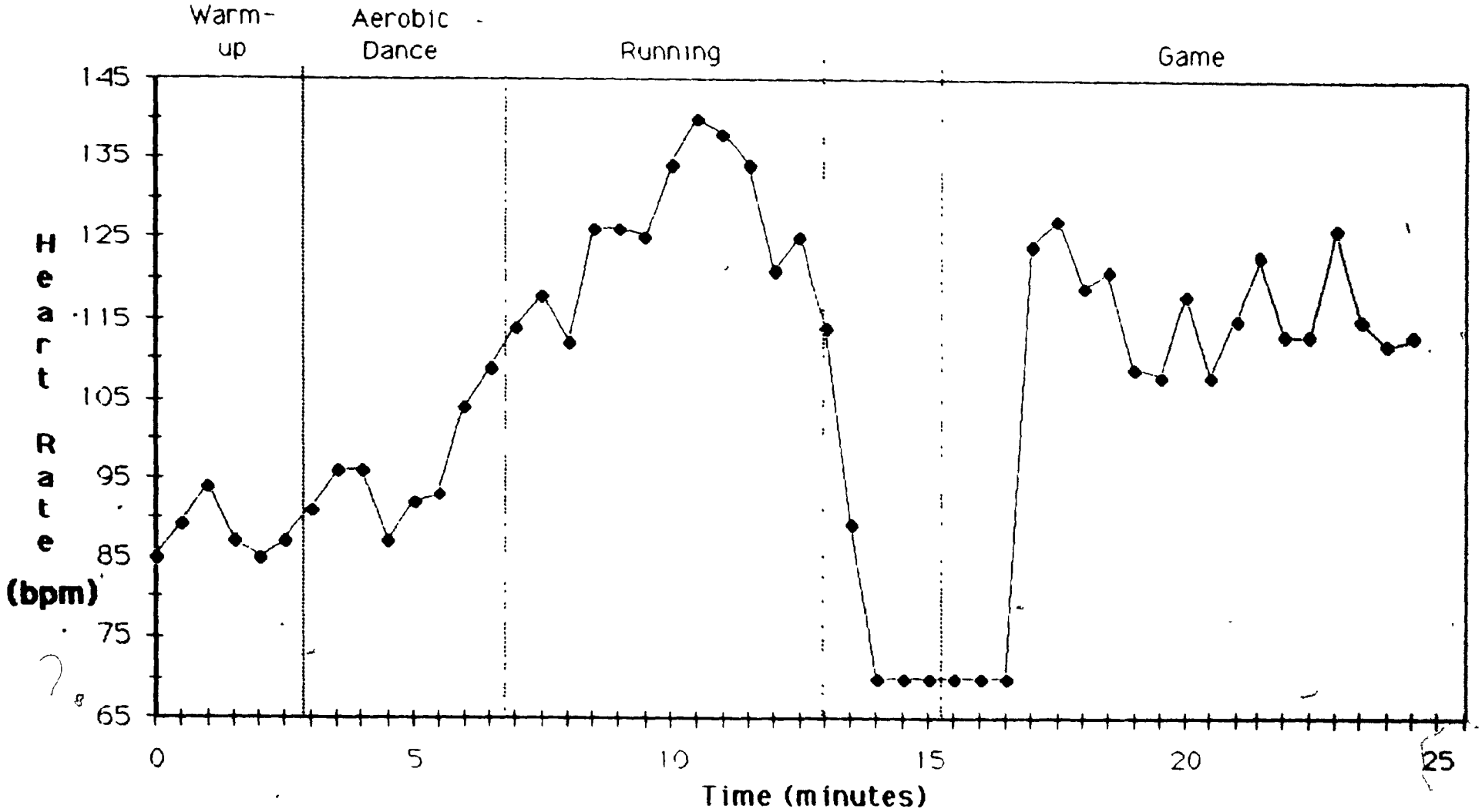

Figure 23 Heart Rate Response of Participant 5 During Session #12

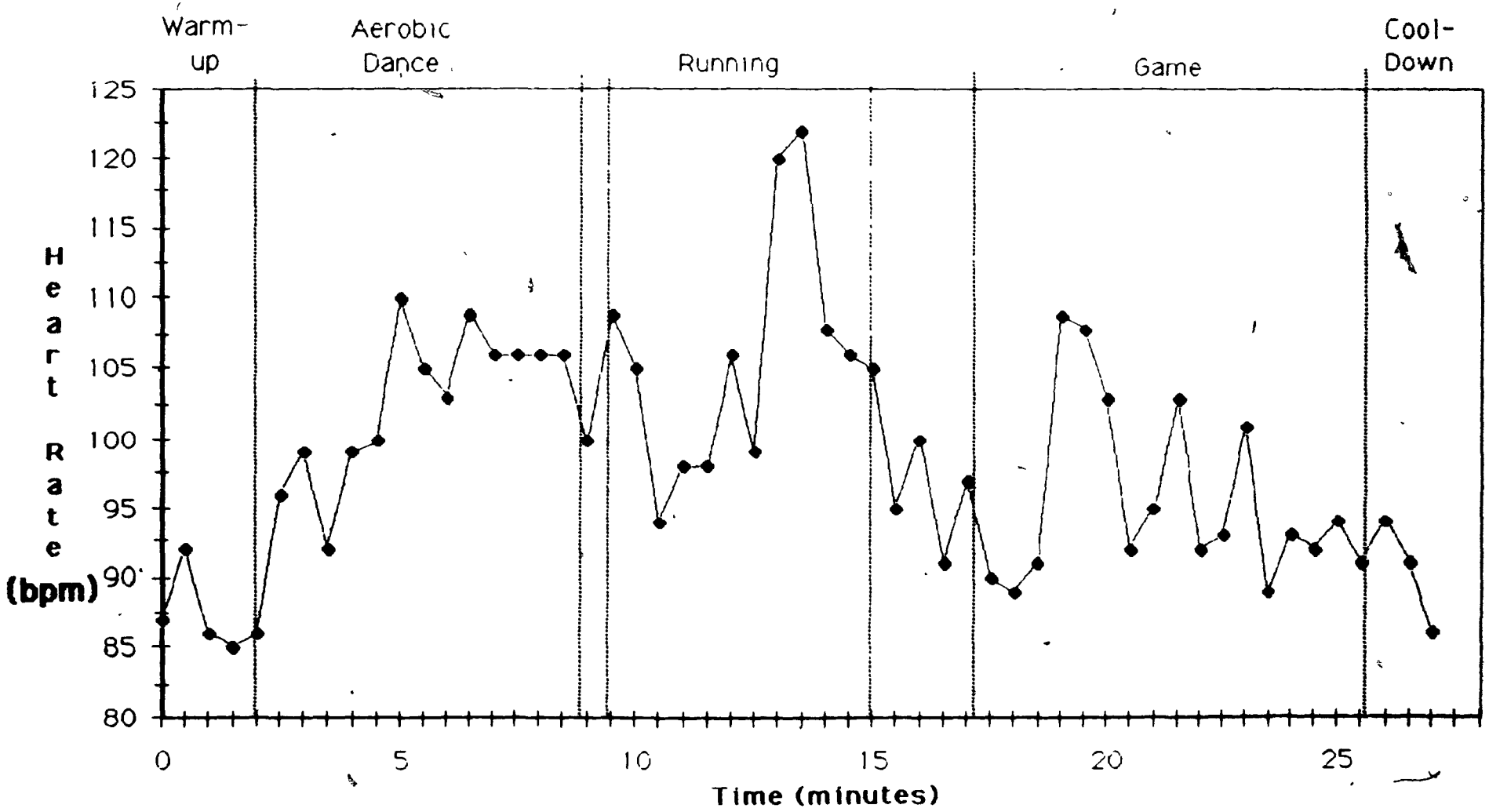

Figure 24 Heart Rate Response of Participant 5 During Session #17

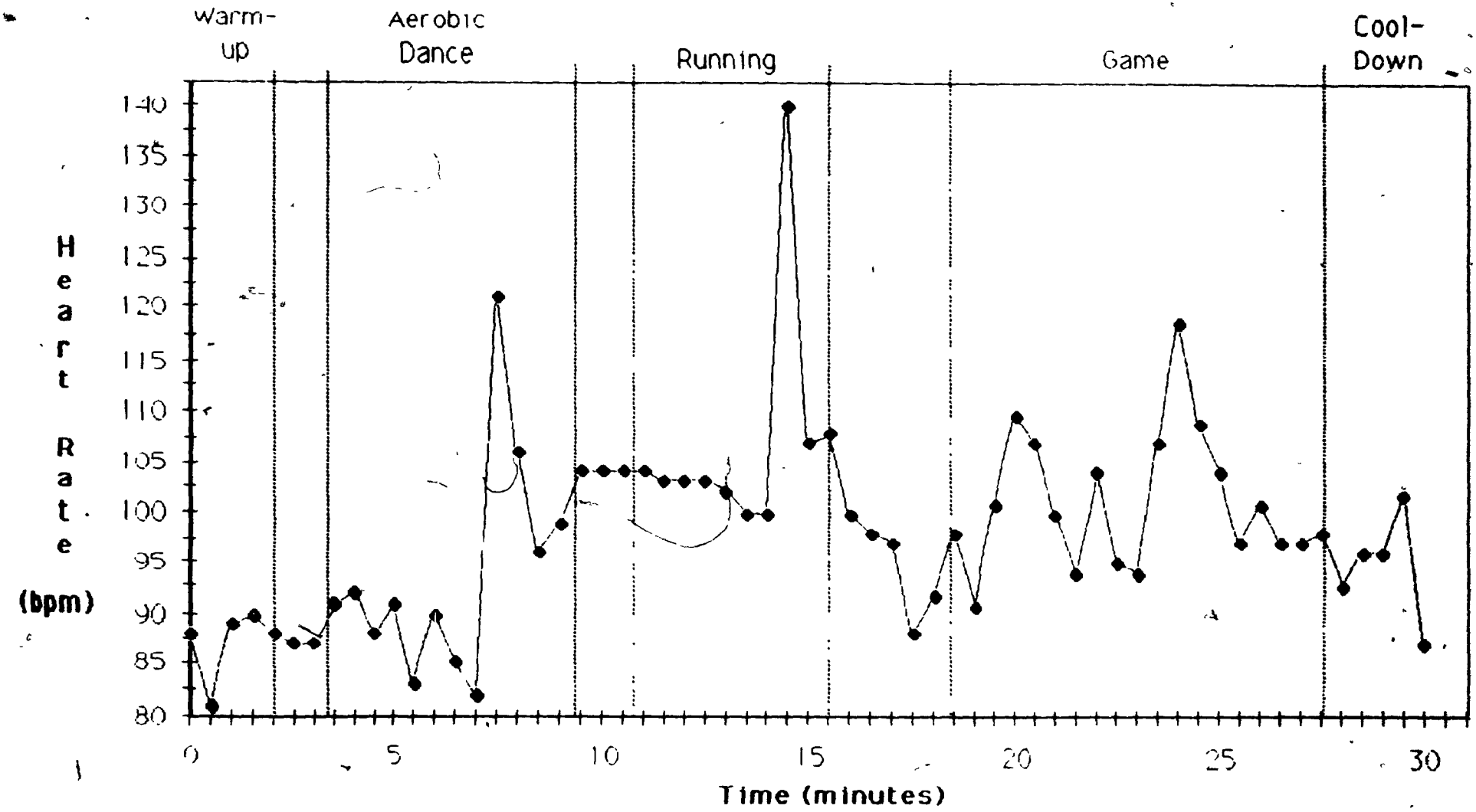

Figure 25 Heart Rate Response of Participant 5 During Session #21

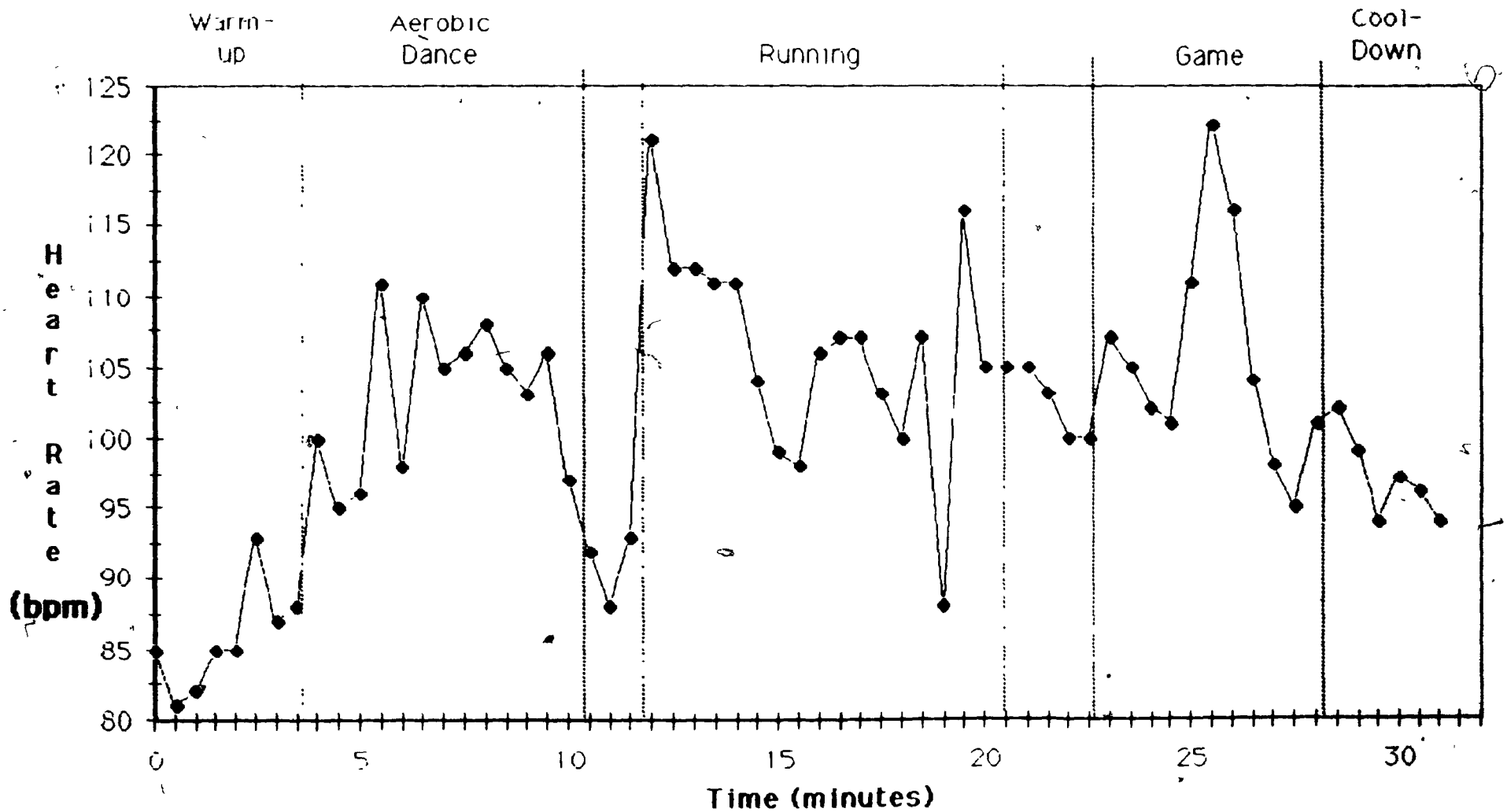

Figure 26 Heart Rate Response of Participant 5 During Session #24