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ABSTRACT

This handbook is designed for the physical education teacher who wishes to emphasize or reinforce metric education. The activities described involve applications of physical skills or principles of health with measuring in the metric system or knowledge of metric measure. (JD)

A TEACHER'S HANDBOOK OF MIDDLE SCHOOL OR JUNIOR HIGH SCHOOL PHYSICAL EDUCATION ACTIVITIES EMPHASIZING METRICS

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The description of the Intramural Metric Afternoon outlined in Chapter V was provided by Mrs. Marilyn B. Wixson, Mathematics Specialist at Holderness Central School, Holderness, New Hampshire. This activity was planned by the middle school teachers of that school as a capstone to an observance of National Metric Week last spring.

The Metric Field Day outlined in Chapter VI is based upon an interscholastic track meet which has been operated for the past several years in Supervisory Union 48 in New Hampshire. Mr. Charles Lenahan, Chairman of Physical Education and Director of Athletics for the Plymouth schools, has operated this track meet with the seven elementary schools in Supervisory Union 48 participating.

We also wish to thank Mrs. Margaret Langdon, our secretary, who has faithfully produced the manuscript.

CHAPTER I

INTRODUCTION

Our objective is to prepare a handbook that will be useful for a teacher of physical education in a middle school or junior high school in emphasizing or reinforcing metric education. The activities described in this handbook were selected because they involve applications of physical skills or principles of health in an interesting manner with measuring in the metric system or knowledge of metric measure. In general, the activities suggested can be modified to fit most any teaching situation.

We strongly recommend that you do not have children do conversions from English to Metric. Instead, everyone should "think metric". This means that you, the teacher, will have to obtain metric tapes and scales in order to re-measure your distances, heights, weights and so on that you used to know so well in English units.

In fact, a useful activity for some of your students will be having them assist you in recording these measurements metrically. Where possible, we suggest you reline your playing surfaces in metric units that are "nice integers", such as 20 meters, rather than leaving the old line of 20 yards and recording 18.4 meters.

There is no question that some games, especially football, will never change. Hence, a football field will still have 100 yards between goal lines. There is no need to record this as 92.2 meters or to talk about "first down and 9.2 meters to go."

Most children are aware that olympic track and field events are in metric units. You can easily have children do these kinds of activities using metric measurements and we assume that you will do so.

The balance of this handbook describes activities for outdoors, indoors and health class. We also describe an eight station intramural metric afternoon and an inter-school metric field day which were successful experiences for larger groups of students.

CHAPTER II

OUTDOOR ACTIVITIES

A. Metric Dashes

The basic running event is the 50 meter dash. If you have space, this distance can be laid out in marked ten meter sections and, hence, be useful for several of the other activities described later in this handbook. Even if a track-like area is not available, relays in 100 meter portions are possible by setting a turning post at each end of the basic fifty meter distance.

If a track area is available, we suggest that it be marked in 100 meter sections. A track of 500 meters will be ideal, although 400 meters will be the usual replacement for a 440 yard (402.34 meters) track.

B. Metric Hopscotch (8)

This variation of a favorite game for fourth or fifth graders requires the usual hopscotch layout and a set of cards with a "metric question" on each. A player draws a question each time prior to tossing his/her marker. If the question is answered correctly, (correct answer is on the back of the card), the marker is tossed and the hopscotch game proceeds. If not, the next player takes a turn.

The questions can be on metric conversions, kind of metric unit to measure a quantity, common Celsius temperatures, and the like. A set of Metric Flash Cards (2) is ideal.

C. Jogging Metric Style (5)

For this activity you will need to map out a course of one kilometer. (Alternative courses of one kilometer each will be useful.) In your record book record each time a student jogs a kilometer. When a student reaches ten kilometers, he/she is awarded a jogging ribbon stamped "10 km" and her/his name is added to a prominently displayed chart of "Members of the 10 km Club". As a child continues to accumulate "kilometerage", her/his ribbon is stamped for each additional ten kilometers and name is added to higher ranking club charts for 20 km, 30 km, and so on. A trophy may be awarded at the end of the school year for the greatest accumulated distance.

D. Metric Jogging Meet (1)

The object of this meet is to see which two-person team can accumulate the most distance by jogging, running, walking, crawling or what have you in a set period of time--say one hour or one class period. A 400 meter track or course with markers at each 100 meter point is needed. One person on each team traverses the course carrying a thirty centimeter baton which is passed to the second team member. While the second team member tranverses the course, the first reports to the scorers table and rests. Pacing and conservation of one's energy is important. At the end of the designated time, the last 100 meter post passed is the recorded distance for that turn around the track. Teams of one boy and one girl will add interest and enable this activity to operate on a coeducational basis. Several meets could be recorded during the year, thus giving each participant a chance to have pride in improved performance.

E. Your Metric Pace (4, 7, 9)

With this activity you will need one or more, depending upon the size of the class, ten meter tapes stretched taut on the ground. Have each student go ten normal paces, that is, in steps in a normal fashion. At this point, a student should record to the nearest decimeter the distance he/she has traveled. When this distance is divided by ten, each student will have the length of her/his pace to the nearest 100th of a meter.

The students are now ready for you to give them a list of distances to measure by pacing. These distances are ones that you as the teacher should have previously measured, probably using a trundle wheel, although you ought to practice your own pace as well. Kinds of distances that students might be asked to measure by pacing would include the length of the school, the distance between two trees, the length of the school driveway, the various distances around the sides of a playing area, and the like. The goal should be for each student to complete these measurements with an accuracy of plus or minus 10% of the distance as measured by the trundle wheel. This is a fairly high goal but it can be met with a little practice. Estimating distances by pacing should be within at least 20% accuracy as a minimum criterion. Those students who cannot reach the minimum accuracy test should be encouraged to re-measure their paces and observe whether or not the initial ten paces that they do for measurement purposes are a normal walk that they can then transfer to estimating some other distance.

An interesting sidelight activity that students can do by pacing is to estimate the height of a fairly tall object such as a tree. To do this, the student paces away from the tree a distance that he/she estimates to be the height. At that point, the student stops and, without turning around, leans down and looks through her/his legs to see if she/he can see

the top of the tree. If not, the student then walks forward or backwards (after straightening up of course) and takes another sighting. At the point where the top of the tree can be seen by looking down and backwards between the legs, the tree height will be that distance from the base of the tree. In effect, the person has formed an isosceles triangle with the height of the tree and the distance paced away from the tree as the equal sides. The students might wish to check their estimates by borrowing a clinometer from their mathematics teacher and estimating the height of the tree using that measuring device.(2)

F. Metric Estimation Olympics (3, 8)

This activity consists of four events where the emphasis is to be placed on coming the closest to the distance indicated rather than being the fastest or the strongest. The distances indicated in the following events may obviously be adjusted when considering the age of the participants. The events are the 30 meter dash, the 5 meter shot put, the 20 meter softball throw, and the 2 meter broadjump.

For the 30 meter dash, the students have 5 seconds to move away from the starting line to a perpendicular distance that each believes to be 30 meters. The finishing spot of each student should be marked and measured after the 5 second time interval. First, second and third places are awarded on the basis of being the closest, either above or below, to the 30 meter distance.

Using a shot of a suitable weight for participants, each participant puts the shot a distance that that individual considers to be 5 meters. On the first trial, each distance is measured and half of the participants that are the closest are regrouped for the finals. The finalists each put the shot a second time. The distance of each participant is measured and first, second and third places are awarded for the closest puts to the 5 meter

distance.

In the 20 meter softball throw, each of the participants has 3 tries with a measurement for each student to be made after each try. This is a rather difficult event and the three places are awarded on the basis of any throw that is the nearest to the desired 20 meters irrespective of which round it was that the student made the throw.

The final event is the 2 meter broadjump, and for this event, each participant is allowed one trial. Three places are awarded on the basis of being the nearest to 2 meters, either above or below, among all of the participants.

The nice thing about this metric estimation activity is that it might be repeated at later intervals because any student with a minimum of strength and athletic ability will have the chance to compete on the basis of nearest to the desired estimated distance.

G. Metric Frisbee Olympics

This activity involves five events. The first of these is a toss for the greatest distance. Each contestant tosses her/his frisbee as far as possible from a marked starting line. If the area has lines every ten meters, measuring the results in meters will be facilitated using a metric tape.

The second event involves a toss that comes the closest to an estimated 20 meters. Here the throwing area should not be lined out, but only a starting line should be used. A 20 meter metric tape will be needed for measuring. All contestants in this heat should throw once before any measurements are made. Two tosses are allowed with places determined on the best position of either toss.

The other three events of this activity involve tossing a frisbee with accuracy. It will be usefull to have three separate stations with a starting point and a target for each. Targets on the order of marked circles or hula hoops are appropriate. The tosses should be arranged so that the contestant must throw or toss the frisbee into the target area from a distance appropriate to the age and experience of the contestant, say on the order of ten to twenty meters. One toss to a target straight ahead, another involving a toss with a left hook, and a third involving hitting a target with a toss that requires a right hook. The throws involving the left and right hooks will require a "foul pole" in order to guarantee that the appropriate hook is in the flight of the frisbee. Probably all three distances to the targets should be different. Places are awarded on the basis of being nearest to the target area. All tosses that land in the target area are ties. Tie places are broken by tossing again.

H. Metric Spin Casting

This activity is useful in a situation where most of the contestants can supply their own equipment and involves using a spin casting fishing outfit with a weight instead of the usual fishing tackle with hooks. Some control on the heaviness on the objects to be cast should be instituted. Probably something on the order of fifteen to forty-five grams would be appropriate. Any weight of monofilament line commonly used for fishing in your area should be appropriate, However leaders should be restricted to one decimeter or less.

One station is devoted to a cast for greatest distance. The setup and place awardings are similar to those used in the comparable event in the metric frisbee olympics of section G. Two stations can be devoted to casting an estimated distance such as ten meters and twenty meters. A fourth station

can be set up to test accuracy by having the contestants cast into a hula hoop sized circle set some appropriate distance away, say fifteen or more meters depending upon the general ability of the contestants. In this last event, three casts are allowed and the placings determined on the best of the three casts. Those contestants where one of the three casts lands in the target area are tied. Ties are broken by repeating the three casts after the target area has been moved.

CHAPTER III

INDOOR ACTIVITIES

A. Metric Confidence Course (8)

The confidence course, commonly called an obstacle course, may be laid out to test or develop skills in five areas. These areas are agility, balance, coordination, flexibility, and speed. It might be appropriate to have a student committee to design the confidence course. In any event, the specifications for the course should be dittoed and a copy of the specifications provided for each participant.

One possible test for agility would be to suspend two automobile tires from the rings in such a way that one tire is one meter from the floor and the second one, two meters. The diameter of the opening should be specified and probably is something on the order of 35 centimeters. The participant is to get through the two tires. A mat should be provided underneath the tires.

The usual test of balance is to walk a beam one decimeter in width for a distance of three meters. A readily available test of coordination is for the participant to shoot a ball in a basket three meters from the floor. Flexibility may be tested with instructions to make three or four rolls on a mat for a distance of at least 5 meters. And the final test of speed would be to sprint some distance, say 20 meters.

The confidence course can be used in three ways. The first is to have the participants simply complete each event with no regards to time. The second would be to have the participants complete the events consecutively with a total maximum time limit. And the third would be to make time a factor

in a competitive situation.

B. Measuring Metric Me[8]

Preparation for this activity includes having a supply of dittoed sheets for each student entitled "Metric Me", a bathroom scale calibrated in kilograms, a height chart, an armspan chart, and sufficient metric tapes at least one meter long for half the number of students participating. Weight will be recorded in kilograms and all other measurements are recorded in centimeters. If desired, you can provide a place for a date and two columns of data thus enabling each student to note how he/she has changed between the two dates, for instance beginning of the school year and the end.

As a minimum number of observations on the data sheet, ten measurements can be required including weight, height and armspan. (Have your students note a relationship that most people have, that is their armspan and height are about the same.) Circumferences should include measurements of head, neck and waist. Other measurements of length on the body could be arm, hand, leg and foot.

The class can be paired up with one individual being metric me and the other individual being designated metric measurer for half the period, with the reverse happening for second half of the period.

C. Metric Bombardment[8]

For this activity, you will need a set of metric flash cards[2], a very soft sponge ball, a supply of pencils, and a supply of paper or 3 x 5 cards. The class is divided into teams and play begins by having the students move in random fashion around the room. On signal, everybody freezes. The director asks a question on one of the flash cards and the first person to raise her/his hand is allowed to answer. If that person answers correctly, then he/she has a chance to bombard with the ball a person on the other team. If the person answers the question incorrectly, then that person is out of the game. The

person doing the bombarding has one shot to hit a member of the other team. If that person misses, then he/she is out of the game also.

The person that was hit in the bombardment must answer three questions in rapid fashion in order to stay in the game. Otherwise, that person is out. Those persons that are out write new questions for the director to use. The questions can be used in any order from any individual; it does not matter which team that individual is on. A team wins when all members of the other team are out.

D. Metric Spelling Race[8]

For this activity you will need a set of cards which has been duplicated for each team, probably two, three or four. Each card will contain a question or phrase which requires a one-word answer. These word answers are obviously to be words emphasizing the vocabulary of the metric system. Fifteen questions or so should be sufficient.

The participants are divided into teams and the first person to run is given a piece of chalk. On signal, the persons run to the deck of cards for that team, draw a card and run to the chalk board where the answer to the question is written. Then the individual returns to the starting point and passes the chalk to the next participant.

One point is awarded for each correct answer spelled correctly and one point for each team that was beaten in the foot race. The team with the highest total wins.

CHAPTER IV

HEALTH CLASS ACTIVITIES

A. Food Servings in Liters or Grams

In preparation for this activity you will need a set of scales that will readily weigh quantities up to one thousand grams, a set of measuring cups graduated in milliliters, and a variety of foods in appropriate sizes or representations of these foods in those sizes. Prepare a ditto sheet listing a variety of foods, correlated with the serving sizes you have prepared, classified by foods that will be measured by weight and those that will be measured in milliliters. Possible foods that would be measured by weight would be potatoes, vegetables, meat, eggs, cereals, potato chips, candy, bread, and so forth. Those that would be measured in milliliters would be milk, soda, ice cream, orange juice or any other food which is sold in fluid ounces in the English system of measurement. The ditto sheet should have two columns, one headed Estimated Weight or Volume and the other headed Actual Weight or Volume.

Have the students estimate the weight or volume of approximately half of the items in each classification. Then demonstrate the actual weight or volume of these items by serving size. Repeat the process for the rest of the items. Students should make better estimations the second time around. The activity can close with a general discussion on other kinds of foods that students might suggest together with an estimation of the weight or volume of serving sizes.

B. Calorie Counting[6]

Prepare a dittoed sheet for each student to record the foods eaten for three consecutive days. There should be place on this data collection sheet for meals and snacks. Students should be instructed to record the amount consumed in grams or milliliters, whichever is appropriate. (This activity obviously follows Activity A of this section.)

At the next class meeting, the students can use a food calorie chart which you supply (and some judicious estimation) to total the calorie intake for each day. This information, together with the kinds of foods that have been consumed, will lead to a class discussion of a balanced diet and health.

C. Cigarettes, Metrics and Health

Many popular magazines today carry a variety of attractive ads for cigarettes. It seems that there are many claims and counter-claims as to the "mg. tar" in one brand of cigarette versus another. This activity is designed to demonstrate clearly to the students what smoking means in relation to "tar". Have each student bring at least one cigarette ad from a magazine to class.

The class can discuss the variety of the claims and counter-claims with respect to tar. However, select one which has the phrase "Only 5 mg. tar." as an example. (Note that the 100 pack means 100 millimeters.) Do a simple computation on the board, assuming that a person smokes a pack a day, in which case that person has taken into her/his body 100 milligrams of tar. Now do another computation which demonstrates that in a week that individual would have taken in 700 milligrams of tar. A further computation, demonstrating the number of milligrams of tar in a month and then in a year.

One final computation for five years will result in a number on the order of 200 000 milligrams. This represents approximately 200 grams of tar.

Lead a class discussion of the effects of tar on the body, including the fact that the body does not have a chance to expel the tar if one is smoking. In order to demonstrate to the students just what they are taking into their bodies when they smoke, you can measure out cumulative amounts of creosote into a graduated cylinder using the fact that one gram of tar is approximately equal to one milliliter of creosote. Hence, in five years the individual would have taken in 200 millimeters of creosote which shows up in a clear beaker as a substantial amount of this obnoxious liquid.

CAUTION: CREOSOTE IS A VERY DANGEROUS CHEMICAL. IT IS POISONOUS WHEN INGESTED AND IT BURNS THE SKIN, ESPECIALLY THE EYES. HANDLE THIS CHEMICAL CAREFULLY.

It should not be too difficult to convince students that they would not particularly want to drink this pungent smelling liquid or have it come in contact with their body tissues. However, creosote is a reasonable representation of the tar to be found by smoking cigarettes and provides an excellent opportunity to dramatize some of the hazards of smoking.

CHAPTER V

AN INTRAMURAL METRIC AFTERNOON

The Middle School in Holderness, New Hampshire, organized a metric afternoon that involved four home room classes and lasted about two hours. Eight stations were set up, each monitored by a homeroom teacher, special subjects teacher, or school aid. The classes were divided into eight groups with about 13 students in each group.

Four of the events were the 50 meter dash, the high jump (measured in centimeters), the running broad jump (measured in centimeters), and a 600 meter relay with each group of students divided into three teams. These events have all been described previously. The other four events were liter estimation, scavenger hunt, airplane flying, and weight lifting.

In the liter estimation event, students were asked to estimate the volume of colored water contained in 8 different containers. These estimations were written on a previously prepared dittoed score sheet. A point was awarded if the student estimated the volume in mililiters within a broad limit, such as ± 25%. (Note that this event proved to be very difficult for students and you will need a range on the order of 25% either way in order to get some scoring by some students in the group.)

In the metric scavenger hunt, the students were asked to find a blade of grass 5 centimeters long, a leaf 10 centimeters long from stem to tip, a stick 10 centimeters and a rock that weighed 30 grams. The director of this event will need a meter stick and a pair of scales in order to score the results. Results are scored by awarding three points for the person with

the closest object to the required measurement, then two for the next and one for the last. The highest total wins the event. Note that the scoring on this event takes some time and the results will not be known immediately. The students are to estimate that they have found the required object rather than have some sort of measuring device available.

The seventh event was an airplane flying contest. This event required some preparation on the part of the student. They were told ahead of time to design a paper product airplane which was to weigh between 2 and 20 grams. They were to write the dimensions of the paper before it was cut, and the dimensions of the airplane after it was cut or folded. These dimensions to be written in centimeters to the nearest tenth. A limit of six regular paperclips for purposes of weight was imposed. In running the event, students lined up on a firing line and flew their planes. The perpendicular distance that the winner went was measured. A second round followed. If there were two different winners in the two rounds, then a run-off of these two was needed to determine the winner.

The eighth event was weight lifting. Each of the weights on the barbells was converted to kilograms. The group was separated into finalists by having the students press heavier and heavier weights. Two rounds of presses were usually sufficient, taking care that the amount of weight to be pressed was kept appropriate for the age of the students participating. The winner was determined by the number of presses that that individual could do in a given time limit, say three minutes.

In all events, a boys winner and a girls winner was determined in each group (with the exception of the 600 meter relay where the teams were co-ed) and ribbons were awarded.

CHAPTER VI

AN INTERSCHOLASTIC METRIC FIELD DAY

A. Invitation

SUPERVISORY UNION METRIC FIELD DAY

The following teams are being invited to a 5th grade through 8th grade metric field day at "place" on "date" :

"List names of schools"

The meet will start at 9:00 a.m., with the events taking place in the order listed on the enclosed sheet. Every team accepting may enter a maximum of five contestants in each event unless otherwise stated on the schedule of events sheet. Each individual contestant may enter a maximum of three events plus a relay, unless otherwise cleared through the meet director.

There will be a lunch break from 11:30-12:00 for all the contestants. Contestants should bring their own lunch. However, hot dogs and drinks will be on sale.

Please sign and return the enclosed sheets of information by "date" . Thank you.

Sincerely yours,

_____

Name

Meet Director

B. Personnel

1	Meet Director and Announcer
1	Head Scorer
1	Starter
1	Head Finish Judge
1	Head Timer
7	Timers
1	Head Official for Long Jump
1	Head Official for Girls' High Jump
1	Head Official for Boys' Softball Throw
1	Head Official for Girls' Softball Throw
1	Head Official for Boys' High Jump
20	Officials for Field Events (4 each)
7	Relay Judges

C. Schedule of Events

Morning Events

9:15	Softball throw, Long jump	Boys
9:15	Softball throw, High jump	Girls
9:15	50 meter dash (5th & 6th only)	Girls
9:30	50 meter dash (5th & 6th only)	Boys
9:45	50 meter dash (7th & 8th only)	Girls
10:00	50 meter dash (7th & 8th only)	Boys
10:00	High jump	Boys
10:00	Long jump	Girls
10:15	100 meter dash	Girls
10:30	100 meter dash	Boys
10:45	400 meter run (3 per school)	Boys or Girls
11:00	3-legged race (5th & 6th only) (Unlimited number of entries)	Girls
11:10	3-legged race (5th & 6th only) (Unlimited number of entries)	Boys
11:20	800 meter run (3 per school)	Boys or Girls

11:30 - 12:00 Lunch Break

Afternoon Events

12:00	200 meter dash	Girls
12:15	200 meter dash	Boys
12:30	400 meter relay (5th & 6th only)	Girls
12:40	400 meter relay (5th & 6th only)	Boys
12:50	400 meter relay (7th & 8th only)	Girls
1:00	400 meter relay (7th & 8th only)	Boys

Presentation of Awards

1:10 - 1:30 First Place Team Trophy
Second Place Team Trophy
Third Place Team Trophy

1st, 2nd, 3rd, 4th, and 5th place individual ribbons for each event to be given to the coach of each team for presentation back at a student's own school.

D. Additional Information

1. In an effort to equalize the competition, each school will receive the following points for each event. These point values were determined by the size of the school and by its past performances in this competition. Points for each event are as follows:

(Describe point awards here.)

2. In the high jump event, only a one-foot take-off is allowed--a two-foot take-off is illegal.

3. In the 400 meter run, you enter your three best participants, boys or girls.

4. You may enter as many fifth and sixth grade three-legged race contestants as you want. You do not need to sign these entries up by name.

5. When listing your entries on the enclosed entry sheets, please list all your running entries in order with the fastest first, and all your field entries in order with the best last.

6. Many officials are needed to help make this meet run smoothly. If faculty members will be coming with your team who could help us out by being officials, please send their names in with your entry sheet.

7. Running events will be in timed heats with one entry per school per heat.

8. High school students on the track teams will be assisting by acting as officials.

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