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SCIENCE BULLETIN

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OUR WEATHER

General Science

There is probably no subject which so fully occupies our attention or is of more significance to us than is the weather. It is also probably true that there is no subject about which the average individual knows less. Superstition and ignorance run riot in the minds of those who know little about the cause of our weather. To the end that a little light may be shed in darkened minds where superstition plays havoc, the writer ventures this short article. The suggestion may give the teacher of general science a new urge to carry on along this line in the development of general science study projects.

The duty of the public school, as well as higher institutions of learning is, to produce an educated public mind which can readily distinguish between truth and error, and fact and superstition.

It is no longer necessary to be entirely ignorant of the causes that produce changes in our weather. To understand the delicate mechanism back of such changes is to know and appreciate the working out of certain definite laws. This knowledge has come as the result of long, careful, and painstaking observation of facts from which generalizations and laws have been deduced. To this new science the name meteorology has been given.

A subject which affects every aspect of human life should be of great utility. Our daily plans are made or unmade on account of the weather. Our various changing moods and fancies depend upon the weather. Untold destruction to crops and property, the loss of life through storms, floods, electricity, and sudden cold is of common occurrence. Before the introduction of the science of weather forecasting in America, the annual loss due to these causes was very great. Man was at the mercy, apparently, of this great unjust chastiser. Severe storms with heavy precipitation caused sudden disastrous floods; sudden frosts nipped the delicate fruits and caused widespread suffering of livestock; hurricanes destroyed life and shipping along the Gulf and Atlantic seaboard; tornadoes appeared with sudden death dealing destructiveness to life and property; sudden gusts whipped the Great Lake waters into diabolical fury and who was there to tell the cause of all and bring security and safety out of chaos.

The first attempt to forecast weather changes and to study scientifically their causes was made in 1869 by Professor Cleveland Abbe, Director of an observatory in Cleveland, Ohio. So successful was Professor Abbe in his work that a bill was introduced into Congress in 1869, by H. E. Paine, Congressman from Wisconsin. This bill carried an annual appropriation of $20,000 for the purpose of maintaining a Weather Bureau. The first weather forecasting was started on Nov. 1, 1870 and the first weather map was produced Jan. 1, 1871. At first the Weather Bureau Service was placed under the War Department, but in 1891, it was placed under the U. S. Department of Agriculture with headquarters at Washington, D. C.. So efficient has our weather service become that it is now the world's leader along this line. The annual saving to agriculture, shipping, loss from floods, destruction of life and property far exceeds the small annual outlay of $1,600,000 that it costs us to maintain it.

The United States is divided in two different and distinct ways for the purpose of securing climatological data and making daily weather forecasts. In the first place, there are twelve climatological districts. These districts are North Atlantic States, South Atlantic and East Gulf States, Lake Region, Ohio Valley, Upper Mississippi Valley, Lower Mississippi Valley, Missouri Valley, Texas Rio Grande Valley, Colorado River Valley, Great Basin, Columbia River Valley, and California. For forecasting purposes, the U. S. is divided into six districts with centers in Washington, D. C., Chicago, St. Louis, New Orleans, Denver, San Francisco, and Portland, Oregon.

Three types of stations scattered throughout the country gather various types of weather data. There are the regular stations about 200 in number, 3000 cooperative stations, and 500 special stations. To operate a regular station, requires from one to fourteen men, while special stations and cooperative stations require one each. A regular station is usually located in a large city where the weather maps and weather reports can be quickly disseminated to a large number of people. The various types of weather data instruments found in all regular stations are, maximum and minimum thermometers, barometers, wet and dry bulb thermometers, a tipping bucket rain gauge, weather vane, sunshine recorder, a standard thermograph for securing continuous temperatures, and an anemometer for measuring wind velocities. Observation at all regular stations are taken at 8:00 a. m. and 8:00 p. m., Washington, D. C. time and include the following: dry thermometer readings, wet thermometer readings, maximum and minimum temperatures, wind direction, wind velocities, amount of moisture, form and nature of precipitation, clouds, (kinds, upper and lower), condition of sky, and pressure readings. Cooperative stations are provided with standard thermometers and rain gauge and are required to report monthly on daily temperatures, amount and kind of precipitation and cloudiness. Special stations are given certain problems to work out which require a considerable time to solve.

Observations made at the regular stations are not telegraphed in figures or sentences, but are all reduced by means of a very ingenious, complete, and satisfactory code to a series of words. A code message may therefore contain several words in which is all the information required from a regular station. The following is a code message sent to Washington, D. C. from Pittsburg, Nov. 5, 1909. Dogfac, saman, effigy, summear. Similar messages from the 200 regular stations throughout the U. S., southern Canada, and northern Mexico come in to Washington, D. C. every morning between 8:00 a. m. and 10:00 a. m. Condensing the messages to a code form reduces the time and cost of telegraph service to the country.

As soon as the messages begin to come into the head office at Washington, D. C. an exchange of telegrams is accomplished by a circuit system whereby some collecting center sends them as a unit through a series of stations connected up as a continuous unit. This system of circuits is changed from time to time and must be worked out with the greatest of care, so as to make the amount of telegraphing, and thus the expense, a minimum. As soon as the messages at a station commence to come in, one of the station's assistants begins to translate the cipher code into good English. This is easily done by means of the code book. Another man will place on a blank weather map beside each station reporting, the pressure, temperature, condition of sky and wind direction, using in each case, certain symbols. After this has been done the regular forecaster who is an expert, places on the map the temperature lines, isotherms, and pressure lines, isobars. From this data the weather forecast is then made for the next 48 hours. The central station at Washington, D. C. and many of the regular stations issue daily weather maps which give both in the form of a chart and in tables the data received upon the daily observations. In addition to issuing daily weather maps, several other methods of scattering information such as newspapers, flags, cards, telephone, and radio are employed.

It is now known that our weather is daily influenced by great air eddies called "Highs" and "Lows", or anticyclones and cyclones which move eastward across the northern hemisphere. Many theories are given as to the cause for these eddies but the true explanation, as yet, is not known. These storms are not destructive, but are responsible for causing our great extremes of weather. A cyclone is a large, moving non-destructive inward whirl of the air, counter-clock-wise in the northern hemisphere, carrying with it, as a general rule, warm, cloudy, rainy, or snowy weather. An anticyclone is a very large, moving non-destructive outward whirl of the air, clockwise in the northern hemisphere, carrying with it, as a general rule, clear, cool weather. Knowing the nature of these disturbing centers as to direction of travel, rate of travel, and the changing meteorological elements associated with them, it is possible by means of the data gathered from the stations throughout the country to forecast our weather in advance with a reasonable amount of certainty. This leaves little room for speculation or guessing. It gives to the public a scientific interpretation for weather changes and thus robs the mind of error and superstition.

E. J. Cable.

A HEALTH PROGRAM

Health

Now that school is well started, suppose we stop and make an inventory of our health to see how well we are equipped to carry forward a successful year. Most of us (students and teachers) have played in the open during a large part of the summer and have come back to school with a health reserve which we have borrowed from fresh air, sunshine, and physical exercise. As a result we will pass by the first couple of months with few absences due to illness. What a record we could make as a school if we could only maintain this near perfection attendance and vitality for the remainder of the nine months. Statistics show, however, that we do not maintain the first month's record. Soon the silence of the study hall will be broken by fits of coughing, and absentees will return after a few days bearing the old timeworn legend—"Please excuse—illness."

It is useless to talk of the terrific economic loss of school time due to illness, or how it adds to the burden of both student and teacher. We cannot express it in terms of dollars and cents. It is simply a colossal debt which we pay in human suffering, lessened efficiency shortened lives, and economic loss. Why talk about it? We know all about it already. Our intellect tells us that we can avoid these illnesses if we but try. What we lack is a compelling motive which will reach us through our emotions when our intellect is too lazy to grasp the subject. The purpose of this paper is to set forth just a few factors in a health program with the hope that they may be of some assistance in arousing the students to a consciousness of the meaning and importance of health.

To begin with, suppose we go back to last year's records and find the number of days each person was absent from school, and prepare the data in chart form where each student can see what his or her record was. Most of them will be surprised to find out how much time they actually lost. In many schools you will find that you could have shortened the school year two or three weeks, and still made the same progress had you had perfect attendance. If students are grouped into classes on the chart according to their record of attendance, you will have begun to produce a consciousness of the health problem.

Suppose now, after the students have had a few days to digest the first chart, we prepare a chart to be posted in a conspicuous place on which we put the names of all those who have not been absent from school thus far this year, and make some black mourning strips to be pasted over their names on the occasions of their first absences. This

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SCIENCE BULLETIN

Issued Monthly. Entered as second class mail matter at the post-office, Cedar Falls, Iowa, under the act of August 24, 1912.

We have on our desk a great many answers to our inquiry concerning SCIENCE BULLETIN. Since letters are still coming in, we have not yet tabulated the information so as to come to any conclusion as to what most of you want. We do feel encouraged by your generous response and because so many Iowa teachers have found SCIENCE BULLETIN helpful. We will endeavor to furnish as nearly as we can within the limits of our space that which the high school teachers most desire. We welcome comments, questions, and contributions from you.

SOME SUGGESTIONS CONCERNING THE MANAGEMENT OF THE LAYING FLOCK IN WINTER

Agriculture

I. Community Poultry Survey.

The following outline will serve as a basis for the survey. After the completion of the survey make a study of data and draw conclusions as to cause of the failure of some flocks and the success of others.

Suggestive Survey

1. Are your chickens a paying proposition?
2. What do you keep in regard to records?
3. Do you cull your flock?
4. What method of culling do you use?
5. How often and when were the flocks culled?
6. What effect if any was noticed on the flocks after culling?
7. What do you do with your culls?
8. What price per pound did you receive for culls?
9. What number did you cull?
10. What method of selection was used in establishing the breeding flock?
11. What is done with male birds after breeding season?
12. What is the name of the breed? Variety? No. hens? No. roosters?
13. What is the egg production per week, month, or year?
14. Do you buy eggs for hatching or do you buy the chicks?
15. What method of incubation do you follow? Of breeding?
16. How many chickens did you hatch? How many chicks have you today?
17. What was the cause of your loss?
18. What feeds do you give the chicks?
19. What is the type of feeder?
20. What ration do you feed the laying hens?
21. Do you use a scratch litter?
22. Do you measure feed per bird?
23. Do you use any green feed in winter months?
24. What system of watering do you use? Fountain or pans?
25. What type of hen house do you use? Size and location.
26. What system of ventilation is used?
27. What kind of floor do you have?
28. What type of roost is used? Slant, level, material used.
29. What type of nests are used? Location, size, height from floor.
30. What do you do with broody hens?
31. How often do you disinfect? Material used.
32. At what weight are male birds marketed?

Name of owner.
Date.
Location.

II. Utilization of the Survey:

It is evident that the information secured by a survey can be turned to practical classroom work. For example, the class work on diseases, feeding, housing, or breeding can be built up from the facts secured in the survey. Let us see how this may be done in regard to the housing and the feeding of the laying flock in winter.

A. Select about one-half dozen of the most profitable flocks which were found in the survey.

B. Study the records carefully and list the managerial factors which seemed to operate in deciding the success of the business.

C. To what extent was the home of the flock responsible for the flock production?

D. What were the desirable features of the home?

E. In what way were these birds prepared for this home?

F. To what extent did feeding influence the production of these flocks?

G. What were the good features of the feeding system?

H. In what way were the birds prepared to utilize the good features of the feeding system?

I. Last month we attempted to show how one could secure through improved methods in management, an increase in the yield of corn sufficiently large to buy a car or to pay for a college education. How much do you believe one could add to this fund by properly managing a flock of 200 hens?

J. Let us assume that this flock will lay an average of 160 eggs. (This is a high average) Let us assume that these eggs sell for an average of 25 cents per dozen, or $666.66. If the cost of keeping this flock could be kept within the limits of $366.66 a balance of $300 would be left to pay the labor income. Study the cost account records which were secured in the survey. Can all expenses of a flock of 200 birds, labor excepted, be kept withing the $366.66 limit? Study cost account records of agricultural experiment stations. Do these records confirm the conclusions drawn from the survey? Would you like to try the management of a flock of 200 hens to see whether this $300 can be made?

III. Presentation of New Subject Matter:

A. If you were given an opportunity to enter a race in which the winner was to receive $300, would you make any preparation? What? Why?

B. Is it possible that some preparation should be made in order that this flock may return a labor income of $300?

C. Some of the well-bred flocks found in the survey were not making as much money as they should. See if by the following improved methods in housing and feeding these flocks can be placed on a basis which will make a labor income of $1.50 per bird.

1. Factors in Successful Housing.
   a. Make the house parasite and disease free. (See "Practical Poultry Management" by Rice and Botsford, pp. 33-208-9); ("Make More from Farm Poultry", International Harvester Co., pp. 29-32); ("Poultry for the Farm Home", International Harvester Co., pp. 20-23); (Special Bulletin 103, "Common Diseases of Poultry", Agriculture Experiment Station, St. Paul, Minnesota.)
   b. Provide adequate interior fixtures. (1) Nests (2) Dropping boards (3) Perches (4) Receptacles for water, grit, and shells (5) Hoppers for dry mash.
   c. Repair and clean windows.
   d. Provide proper litter. (See Practical Poultry Management, Rice and Botsford, pp. 34-194-222).
   e. Place young birds in the house. ("Make More From Farm Poultry" and "Poultry for the Farm Home". International Harvester Co.)
   f. Treat all birds for lice ("Practical Poultry Management", pp 35-36).
   g. Make the birds comfortable by keeping the home dry, clean. warm and well ventilated. ("Practical Poultry Management", pp. 36-63; 215-217.)
2. Factors in Successful Feeding. ("Make More from Farm Poultry", pp. 15-21); ("Poultry for the Farm Home", pp. 25-23); (Cir. 114, Agriculture Experiment Station, Ames, Iowa); (Write Quaker Oats Co., Chicago, Ill. for "Ful-O-Pep" poultry courses).

IV. Summary and Conclusion:

A. Note those flocks with which approved methods of care have been used. What is the return per flock, and per bird after all expenses except labor are deducted? Do you believe a labor income of $300 is practicable from a flock of 200 hens? Are 200 hens the approximate number which one should keep on an average farm? What are you going to do with this $300 if you make it?

B. Write a paper for your English teacher. Show why you think a labor income of $300 is or is not practicable from a flock of 200 hens.

Winfield Scott.

HEALTH PROGRAM

(Continued from page 3)

may not only produce a consciousness of the situation, but an interest in the game.

As yet, we have not mentioned the reasons for absences, and probably it has not occurred to many people that illness was the most prevalent excuse. Suppose now we ask one of the senior classes (preferable the class in physiology or hygiene if you have one) to prepare a chart showing the cause for absences. If the executive officer has kept the excuses for absence filed it will be a simple matter to prepare such a chart. If there are no records available have the class make a survey using any procedure they may decide upon, and prepare their results in such a way that they may be made readily available to the school. In this, we will have accomplished a twofold purpose. We will have enrolled one group definitely in the cause of health, and will have added a little more fuel to the fire of curiosity.

The preceding suggestions are only a few of the many studies that may be made and charted. Consult your State "Course of Study for Elementary Schools" and have different pupils write to some of the references given in the part dealing with health. Also write to any of the leading life insurance companies or consult local agents for health statistics. You will soon have collected a mass of data which can be used in many ways. You can compare your school with others in the health problem; you can compute the economic loss to the community resulting from poor health; you can chart the types of illness which are most prevalent; and in fact there is almost no limit to the possibilities for health education propaganda.

If charts of the type mentioned are rotated with sufficient frequency so that students will have time to digest them but not to tire of them, each addition will add to the health consciousness of the students. If, in addition, different groups of students are used to make these studies and prepare the results in a form suitable for the rest of the group, you will have secured many converts to a health campaign.

With this sort of a campaign well launched we must look about for something that will not only educate the student body as to the value of being well and produce a health consciousness, but will develop a motivating idea. In a sense we are all idealists. Our intellect may tell us the proper procedure to follow, but unless we have some sort of an ideal which will arouse our emotions, we are prone to neglect the dictates of our intellect. Consequently we need something more than educational propaganda to properly launch a campaign.

Why not secure the cooperation of the art teacher and the art classes in the campaign? It will add to the efficiency of the art work because it provides a more definite purpose for the work. It will also secure the interest of another group of students in health as an ideal.

The possibilities of using posters in such a campaign are almost unlimited. First of all we must study the people who are to be approached and determine what particular types of ideals will have the greatest appeal. Some will be interested in becoming great athletes, some will be impressed by the value of health in personal appearance, some will be enticed by the prospect of better grades with increased physical efficiency, while others can be induced to enter whole heartedly into the program merely from the standpoint of the idea as a game. In no case should the idea of "health for health's sake" be held up as an ideal. Health in itself has no value worth striving for only as it enables the possessor to be of service. Consequently we must always present an ideal beyond that of health alone.

A poster campaign, as well as any other, must be well planned. Most of the results hoped for will be lost if we display a hodgepodge group of posters without any idea of continuity or purpose. We will secure more interest if we follow the line of our other campaign and put forth posters depicting only one ideal at a time.

These are only a few of the many possibilities in planning a health campaign. After all the method is not important, the important thing is to do something. Further articles will deal with the direct problems of teaching health.

H. Earl Rath.

THE SIMPLE MACHINES

Physics

In the discussion of simple machines it is best to begin with the lever and the wheel and axle. Both of these simple machines give us a practical illustration of the principle of moments. The lever is the simpler and clearer illustration and usually presents little difficulty to a student body. The wheel and axle is a device which can be considered to be a continuously acting lever in which the radius of the wheel is the force or effort arm and the radius of the axle is the resistance arm.

For the lever we have from the principle of moments the following equation:

$$F \times 1 = R \times 1'$$

In this equation F stands for the force applied at one point of the lever and R stands for the resistance overcome at some other point. The letter 1 stands for the perpendicular distance from the fulcrum and the line of direction in which the force is acting and 1′ stands for the perpendicular distance from the fulcrum to the line of direction in which the resistance is acting. For instance, in a lever 60 cm. long a force of 100 gm. is applied in a perpendicular direction to the length of the lever at one of its ends. The fulcrum supports the other end of the lever. The resistance acts perpendicularly to the lever at a point 20 cm. from the fulcrum. The force acts upward and the resistance acts downward. What is the resistance? Applying the principle of moments we have:

$$20X = 60 \times 100 \text{ gm.}$$
$$X = 300 \text{ gm.}$$

If the supporting fulcrum were placed at a distance of 20 cm. from one end and the force and resistance were each acting downwards on the two opposite ends, the equation would be, assuming the resistance to be applied at the end 20 cm. from the fulcrum, as follows:

$$20X = 40 \times 100 \text{ gm.}$$
$$X = 200 \text{ gm.}$$

According to a traditional classification, the first problem would illustrate a second class lever. If the force and resistance were interchanged in this problem, it would illustrate a third class lever. The resistance in this case would be much less, only 33 1-3 gm. The second problem above is an illustration of a first class lever.

There is really no need of classifying levers into three classes,—first, second, and third class. The main thing is to get the student to understand clearly the principle of moments. Then all lever problems look alike and much confusion is avoided.

The principle of moments as applied to a wheel and axle would be expressed as follows:

$$F \times r = R \times r'$$

In this case r and r′ stand for the radius of the wheel and of the axle respectively. This equation can be changed to the following for the convenience of solving problems:

$$(1) \quad F \times d = R \times d', \text{ or}$$
$$(2) \quad F \times c = R \times c'.$$

In (1) d and d′ stand for the diameters of the wheel and of the axle and in (2) c and c′ stand for their circumferences respectively. That these two equations are correct is evident since the radii of circles are directly proportional to their respective diameters and circumferences. Also in accordance with one of the simplest axioms of algebra the validity of an equation is not destroyed when both sides of the equation are multiplied by the same factor, therefore in using diameters instead of radii to express the law c. moments as applied to a wheel and axle, we are merely introducing the factor two into each side of the equation. When circumferences are used the factor introduced is 2×3.1416, since a circumerence equals $2\times3.1416\times r$.

In the discussion of the remaining simple machines such as wedge, inclined plane, pulley, and the screw it is best to proceed from the standpoint of the work principle. The wedge, of course, is simply a double inclined plane and needs little comment after the inclined plane has been clearly presented.

The inclined plane is a device by means of which a heavy rolling or sliding object can be raised to a certain height by the application of a force in the direction of the incline, or in the direction of the base, or in any direction, making an angle to either of these. Ordinarily, the problems of the inclined plane are presented to high school students as particular cases in which the force acts either in the direction of the incline or in the direction of the base. Assuming the incline to be frictionless, the following work equation is correct, when the force acts in the direction of the incline.

$$F\times l=R\times h$$

In this equation F stands for the force applied, R for the weight overcome, l is the length of the incline, and h is the height of the plane. The above is a work equation since it declares that the force times the distance through which it acts equals the resistance or weight times the distance through which it is raised. This equation is also an energy equation and illustrates the doctrine of "Conservation of Energy". Since this doctrine is basic in the mechanics of nature and of the mechanic arts the instructor should avail himself of the opportunity in the application of these simple mechanics and fix it clearly in the student's mind. Theoretically in a frictionless machine the work equation shows that the "Input" equals the "Output" of a machine.

When the force applied to an inclined plane is acting in the direction parallel at the base of the incline then the work equation becomes:

$$F\times b=R\times h.$$

In this equation b stands for the length of the base of the incline and h for its height. In cases where the force is applied at an angle to either the length of the incline or the length of its base, the problem becomes too difficult for the high school student who has not had plane trigonometry. However, it would not be amiss for a well informed teacher to call attention to the innumerable other problems that might arise in practice where forces are not acting exactly in the direction of the incline or of the base of an inclined plane.

L. Begeman.

(To be continued.)

NATURE NOTES

There are many fallacies concerning nature that are commonly believed by many people. It is the duty of science to correct these fallacies and superstitions. Below are listed a few very common ones.

1. Horse hairs do not turn into snakes.
2. There is no such reptile as a hoop snake.
3. Snakes do not swallow their young to protect them.
4. The hob-nosed snake, sometimes called a "spreading adder" is not poisonous.
5. The water snake of our latitude is not the real water moccasin and is not poisonous. The poisonous water moccasin or "cotton mouth" is a southern snake.
6. Squirrels do not crack nuts. They gnaw them.
7. Owls are not wise. In fact, they are rather stupid birds.
8. Frost does not cause the leaves to "turn".
9. The leaves are not the "lungs" of a plant. They really are food factories.
10. The phase of the moon has no effect on the growth of crops.
11. Malaria or "chills" is not caused by an emanation from stagnant water, but is caused by a protozoan parasite carried by a mosquito.