BASIC CONCEPTS IN THE FEEDING OF POULTRY AS ACQUIRED BY STUDENTS IN THE AGRICULTURAL HIGH SCHOOLS OF THE PHILIPPINES

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1947

Submitted to the faculty of the Graduate School of
the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
August, 1958

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Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: BASIC CONCEPTS IN THE FEEDING OF POULTRY AS ACQUIRED BY STUDENTS IN THE AGRICULTURAL HIGH SCHOOLS IN THE PHILIPPINES

Pages in Study: 54 Candidate for Degree of Master of Science

Major Field: Agricultural Education

Scope and Method of Study: The major purposes of this study were to consider one aspect or area of learning in vocational agriculture, the feeding of poultry and to discover some of the understandings students of vocational agriculture acquire. A test appropriate for high school students covering knowledges of basic poultry feeding concepts was prepared as well as a questionnaire over current teaching practices and these were sent to superintendents and principals of ten agricultural and rural schools in the Philippines, who in turn, assigned a committee of vocational agriculture teachers to conduct an examination of randomly selected third and fourth year students. Of the seven schools responding, 201 students completed the test. Conclusions were drawn on the basis of the test and questionnaire returns from seven schools.

Findings and Conclusions: Students who only had knowledge in applied arithmetic and/or general mathematics experienced more difficulty in solving arithmetic problems, but students who completed algebra or algebra with a combination of mathematical courses made better scores on the tests. The findings indicate that there exists a deficiency of organized instruction in the field of approved poultry feeding practices. Not all students of vocational agriculture had supervised productive enterprises. Students with more adequate supervised farm training programs which included poultry and other animal enterprises proved to have definitely acquired clearer concepts of poultry feeding than did those having only crop enterprises or a combination of crop with few animal enterprises.

In order that the basic concepts of poultry feeding acquired by students may be permanent and real rather than temporary, the following recommendations were submitted: (1) teachers should make an effort to assist the students in the development of comprehensive farm training programs through continuous application of guidance and follow-up efforts; (2) teachers should encourage all students to have their own supervised productive enterprises; (3) teachers in applied arithmetic, general mathematics, algebra, and vocational agriculture should plan to exert more time and effort in directing students in solving problems pertaining to supervised farm training programs and actual farming situations; and (4) teachers initiate a practical demonstration program involving the proper mixing of poultry feeds utilizing the available feedstuffs in the locality.

ADVISER'S APPROVAL _____

BASIC CONCEPTS IN THE FEEDING OF POULTRY AS ACQUIRED BY STUDENTS IN THE AGRICULTURAL HIGH SCHOOLS OF THE PHILIPPINES

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ACKNOWLEDGMENTS

The writer wishes to express his appreciation to all those who have assisted and encouraged him in the completion of this problem. He wishes to acknowledge Dr. Robert R. Price, his major adviser, for his assistance, advice, and constructive citicisms on this investigation. Recognition is extended aside from his major adviser to Professor Don M. Orr and Dr. Rollin H. Thayer, his minor adviser and Professor of Poultry Science, for their helpful suggestions and criticisms in the preparation of the test and questionnaire before they were mailed to designated schools in the Philippines.

He is deeply grateful and indebted to the faculty of the Department of Agricultural Education, Professor Chris White, Professor C. L. Angerer, Head of the Department of Agricultural Education, and Doctor Robert MacVicar, Dean of the Graduate School.

Appreciation is also extended to Dr. Valente E. Villegas, Professor of Animal Husbandry, and Mr. Mario O. San Juan, Instructor, College of Agriculture, University of the Philippines, and to Mr. Jose F. Luna, superintendent of the Camarines Sur Regional Agricultural School, for sending references and materials involved in this study.

Gratitude is also expressed to the members of the promotional staff on Agricultural Education Division, Bureau of Public Schools; to Mr. Harold L. Kugler, ICA vocational agriculture specialist; and to superintendents, principals, teachers, and students in the Philippines who assisted in this study.

This acknowledgment of gratitude would not be complete without mention of the faith and encouragement rendered by his wife, Sepora, and children - Erlinda, Joel, and Richel.

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CHAPTER I

INTRODUCTION

The Problem

The problem in question is of paramount importance to vocational agriculture teachers since it is generally accepted that a basic principle of vocational agriculture is that supervised farming practice and other farming activities greatly facilitate learning, insure retention and make possible a more completely integrated learning process. Supervised farming programs provide opportunity for students to apply knowledge and skills learned at school to their home situations. The primary aim of vocational education in agriculture is to train present and prospective farmers for proficiency in farming.[1] Vocational agriculture contributes to a vocation by affording a student opportunity to receive guidance regarding the occupation of farming, to progress in farming, and to apply through his farming program the knowledge and skills taught at school.[2]

A person acquires knowledge, techniques, and principles from school which can be applied to many life situations. All genuine education comes about through experience.[3] Each person learns all the meanings

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[1]Lloyd J. Phipps, A Handbook on Teaching Vocational Agriculture (Danville, Illinois, 1956), p. 19.

[2]Ibid, p. 28.

[3]John Dewey, How We Think (New York, 1933), p. 13.

he has; he does not inherit them; one acquires through his experiences.[4] Meanings depend upon experience. Experience is also the surest medium by which to test. Once one understands, action is easy. Understanding a thing consists largely in seeing why it is true. Nothing is really known unless it is understood.[5]

What is learned is what is practiced; continued practice or use is usually necessary for retention of the learning.[6] With continued practice, the individual becomes increasingly proficient until his task may be regarded as mastered. Learning is thus revealed as more and more of the same kinds of response, rate and accuracy being the primary determiners of efficiency.[7] The chief function of practice is to improve the understanding of the learner.[8] Putting into effect supervised farming practices in poultry feeding should add clearer understandings of principles involved. To grasp the meaning of a thing, an event, or a situation, is to see it in its relationship to other things. Concepts enable us to generalize, to extend and carry over our understandings from one thing to another.[9] A child has found he can carry over from one experience to subsequent experiences certain learned concepts. He tries to apply to every new experience whatever from his old experience

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[4]Carsie Hammonds, Teaching Agriculture (New York, 1950), p. 31.

[5]Ibid, p. 44.

[6]Ibid, p. 13.

[7]Robert A. Davis, Educational Psychology (New York, 1948), p. 293.

[8]W. D. Commins, Principles of Educational Psychology (New York, 1937), p. 345.

[9]John Dewey, How We Think (New York, 1933), p. 150.

will help him understand it, and as this process of constant assumption and experimentation is fulfilled and refuted by results, his conceptions get body and clearness.[10] And he will become progressively proficient in acquiring new material on the basis of his experience. The ultimate goal is that the learner has so mastered his material that he is able, regardless of the specific material practiced, to generalize it in the solution of problems.[11]

Whenever learning in one context or situation affects learning in another context or situation, transfer of training is said to take place. For all good learning transfers; transfer is always the hope of learning, and when learning is well organized it takes place.[12] Concepts are products of experiences. Concepts are generalizations. Generalization is the basis for transfer of learning -- the learning of one thing being carried over into something else. One has generalized only when he is able to recognize or otherwise use the element of likeness in a new situation containing it.[13]

What the child learns, therefore, depends to a great degree on the nature of environment and the character of experience. Whether he acquires certain skills and abilities will depend upon the opportunities he has to learn them and the kind and amount of practice in which he engages.[14]

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[10]John Dewey, How We Think (New York, 1910), pp. 128-129.

[11]Robert A. Davis, Educational Psychology (New York, 1948), p. 294.

[12]James L. Mursell, Successful Teaching (New York, 1946), p. 70

[13]Hammonds, pp. 28-30.

[14]Arthur I. Gates, Arthur T. Jersild, T. R. McConnell, and Robert C. Challman, Educational Psychology (New York, 1950), p. 291.

A boy who has been taught agriculture by the project method knows how to do things and learns the method of performance. The acquisition of skill in carrying out processes in actual practice is an advantage claimed for the project.[15]

Purpose

The main purpose of this study was to consider one aspect or area of learning in vocational agriculture, the feeding of poultry, and to discover some of the understandings students of vocational agriculture acquire. The following were some of the related purposes:

1. To ascertain the interests of the girl students in vocational agriculture schools regarding their supervised farming programs.
2. To discover if significant differences occur in basic understandings acquired regarding poultry feeding practices between groups of students who have been feeding their poultry and those who indicate having experience in feeding birds in directed projects.
3. To determine the extent of the ability of students of vocational agriculture to solve arithmetic problems concerning the feeding of poultry.

Review of Selected Literature

Several tests were designed and served to evaluate various aspects of learning acquired by vocational agriculture students. Morris gave a test, including a questionnaire, to 200 junior and senior students of vocational agriculture in 19 schools in central Oklahoma to obtain

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[15]Charles A. Prosser and Charles R. Allen, Vocational Education in a Democracy (New York, 1925), p. 275.

an indication of the students' basic understandings of cattle feeding and to ascertain the extent of student ability to solve arithmetic problems related to cattle feeding.[16] The test was divided into five group questions ---- completion questions, arithmetic problems, feed selection table, multiple choice questions, and feed tag selection questions. Individual test scores by students ranged from four to ninety-eight while the mean scores per school were found to vary from 31.3 to 75.0.[17] The highest scoring individual was operating the home farm, in his supervised farm training program, of 15 beef cattle, 18 sheep, 15 swine, 25 chickens, a dairy cow, and oats; the lowest score had oats, wheat, corn, and a lamb for his productive enterprise projects.[18] Morris ascertained that students having no productive projects were found to have only meager concepts of cattle feeding practices.

Cummins concluded that a definite need for improved feeding practices on Texas farms and ranches existed after a teaching plan was put into effect on the use of simple poultry nutritional experiments as a procedure in teaching the feeding of livestock and poultry to vocational agriculture classes.[19] The experimental techniques prepared for use in this study satisfactorily met the good teaching-learning situations.

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[16]Douglas Morris, "Basic Concepts of Cattle Feeding Acquired by Third and Fourth Year Students of Vocational Agriculture in Central Oklahoma" (unpub. M.S. thesis, Oklahoma State University, 1957).

[17]Ibid, p. 16.

[18]Ibid, p. 16.

[19]James E. Cummins, "An Analysis of the Effectiveness of Simple Poultry Nutritional Experiments as a Teaching Aid in Vocational Agriculture" (unpub. M.S. thesis, East Texas State Teachers College, 1954).

Bunch found that soil conservation contests were serving as a means of motivation for learning soil management, but the learning obtained in connection with actual experiences and practices on the home farms led to the highest retention of learning.[20]

Stamps revealed as the result of a test given to 110 junior and senior vocational agriculture students in central Oklahoma that students who had only taken algebra or algebra and geometry had less ability to solve arithmetic problems than did those who had taken composite mathematics. Stamps further explained that while students in agriculture have many experiences which involve the use of arithmetic, they often do not acquire many of the fundamental mathematical skills and concepts involved in solving many problems related to farming.[21]

McClain found that agriculture students with junior standing at the Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, who had completed one half unit or more of algebra and geomtry in high school failed the junior standing mathematics examination as frequently as did those who did not have these courses.[22]

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[20]Merle L. Bunch, "A Study of Soil Management as Taught in 23 High Schools in Central Oklahoma with a Suggested Teaching Plan" (unpub. M.S. non-thesis report, Oklahoma Agricultural and Mechanical College, 1951).

[21]Henry J. Stamps, "Proficiency of Vocational Agriculture Students in Solving Arithmetic Problems Related to Farming" (unpub. M.S. non-thesis report, Oklahoma Agricultural and Mechanical College, 1952).

[22]Glen A. McClain, "Factors That May Have Influenced the Grades Made on the Junior Standing Examinations in Mathematics and English by Students at the Oklahoma Agricultural and Mechanical College in the Fall of 1951" (unpub. M.S. thesis, Oklahoma Agricultural and Mechanical College, 1952).

Delimitations of Terms

Student - is defined as a boy or a girl who has completed at least two years of vocational agriculture and is presently enrolled in vocational agriculture as either a third or fourth year student.

School - is defined as a public agricultural or rural school in the secondary level which has the vocational agriculture and academic departments.

Teacher - is defined as a person who teaches vocational agriculture in an agricultural school.

Copra meal - is a by-product in the extraction of oil from copra and one of the most common ingredients of plant origin used in poultry rations.

Ipil-ipil leaf meal - is a finely ground form of freshly dried leaves from the ipil-ipil (*Leucana glauca* (L.) Benth.) which is a small tree or woody shrub growing wild in the tropics.

Palay - is defined as an unhulled rice or rough rice.

CHAPTER II

METHOD OF PROCEDURE

To obtain data for this study, a test, including a questionnaire was formulated with the assistance of the faculty of the Agricultural Education and Poultry Departments of the College of Agriculture, Oklahoma State University. The test which was so designed to ascertain and obtain an indication of the student's basic understandings of poultry feeding and to determine the extent of student ability to solve arithmetic problems related to poultry feeding, was accomplished by the students. The test with the questionnaire was so planned in such a way that questions would be suitable to the conditions existing in the Philippines. Copies of a test with a questionnaire were mailed and administered to junior and senior students of vocational agriculture in ten agricultural and rural schools, but only seven cooperated in this study. The schools chosen were those in which the writer thought could furnish him a good sampling of all agricultural schools located in different parts of the country. To avoid the teachers from choosing the bright students only in the vocational agriculture classes, an instruction was given to randomize the picking of students from a class. Only students with the numbers 1, 6, 11, 16, and 21 from the class register for 25 students were the ones who accomplished the test. The questionnaire

was so filled out at the same time the test was given. Vocational agriculture teachers were assigned by the principal or superintendent of the recipient school to conduct or administer the test.

The arithmetic problems were formulated on the basis of their practical use in the Philippines. A portion of the questions were designed from a study of Deyoe's standardized tests.[1] Other portions of the questions were formulated from a set of sample questions from the study of Douglas Morris.[2] The remaining portion of the questions were suggested by the advisers. The list of feeds in the feed selection table was properly considered from the feed availability and abundance in the whole Philippines.

The fact that there are girls enrolled in agricultural and rural schools, the test was not limited to boys alone.

The questionnaire was planned to facilitate the study of possible association between test scores and the individual's past feeding experiences, and to provide data for a determination of possible association between the nature and extent of high school courses in mathematics completed and problem solving abilities in farm feeding practices.

The reasons of choosing the agricultural and rural schools for the study were:

1. The geographical locations of the schools to furnish a fair sampling of students to accomplish the test.

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[1]D. P. Deyoe, Deyoe Tests for Understandings and Problem Solving Ability in Agriculture, (The Interstate Publishers and Printers, Danville, Illinois).

[2]Douglas Morris, "Basic Concepts of Cattle Feeding Acquired by Third and Fourth Year Students of Vocational Agriculture in Central Oklahoma" (unpub. M.S. thesis, Oklahoma State University, 1957).

2. The willingness of the school to cooperate in completing the tests and questionnaires.

3. The facility of returning the results of the examinations on time for computations and analyzing of data.

The total number of junior and senior students who accomplished the test was found to be 201 currently enrolled in the seven schools studied. Of the 201 students, 150 were boys and 51 girls.

The ten schools in the Philippines selected to be used in the study, with only seven cooperating, were:

School	Address
Alicia Agricultural and Fishery School	Panganiban, Catanduanes
Baybay National Agricultural School	Baybay, Leyte
Bunawan National Agricultural School	Bunawan, Agusan
Camarines Sur Regional Agricultural School	Pili, Camarines Sur
Indang Rural High School	Indang, Cavite
Negros Occidental National Agricultural School	Kabankalan, Negros Occ.
Nueva Viscaya Rural High School	Bayombong, Nueva Ecija
Roxas Memorial National Agricultural School	Guinobatan, Albay
Santa Maria Agricultural High School	Sta. Maria, Ilocos Sur
Upi Agricultural High School	Upi, Cotabato

A committee of two or three vocational agriculture teachers was assigned by the principal or superintendent of the school to conduct the test at a certain designated time and date.

The writer divided the results of the test into four groups for the purpose of analyzing a portion of the data. Group one included those students having only animal enterprises. Group two included those students

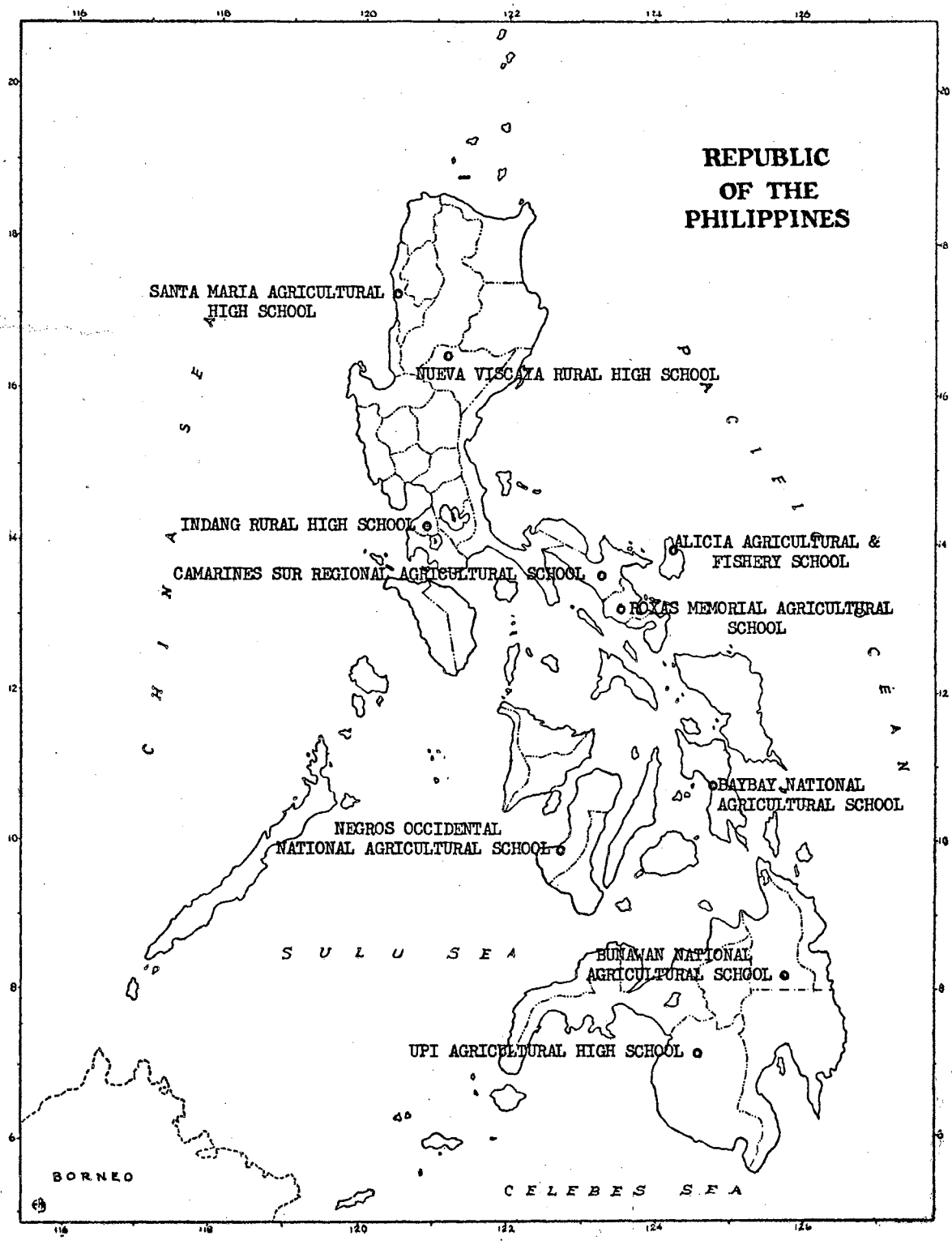

Figure 1. Distribution of Schools in the Philippines Permitting a Fair Sampling of Vocational Agriculture Students Taking Test in Poultry Feeding.

having both animal and crop enterprises. Group three included those students having only crop enterprises. Group four included those students having no productive enterprise projects.

Individual student scores were mailed to the students when requested. Concise summaries of areas of weak points of the students were included with the mailing of the scores.

The tests were graded on the basis of 100 points with the following breakdown:

1. Completion questions . . . . . 24 points
2. Arithmetic problems. . . . . 28 points
3. Feed selection table . . . . . 28 points
4. Multiple choice questions. . . . . 20 points

Total 100 points

Data secured were properly tabulated and analyzed. The mean and median scores of different groups were compared and examined.

A copy of the test and questionnaire is included in the appendix.

CHAPTER III

PRESENTATION OF DATA

The wide variation of responses from the test given to 201 students from seven agricultural and rural schools in the Philippines indicated that the students had varied interests as shown by the number of productive supervised farming enterprises per student which ranged from six down to none. A total of 124 of the students had poultry enterprises for egg production. Thirty-eight per cent of these poultry-enterprising students raised capons on the farm on free-range system of feeding. Most of the capon raisers specified that they fed their fowls with whole corn grains and freshly grated coconut meat.

For egg production, twenty students used commercial ready-mixed feeds to feed the laying chickens. Fish meal was the ingredient most often incorporated with the laying ration as a source of protein for the flocks as indicated in Table I. Copra meal, corn, and rice bran were the other three ingredients which the students usually used for mixing with the basal ration. The fact that most layers raised were exposed to direct sunlight, only four students supplemented their rations with cod liver oil. The ground sea shell was the predominating mineral ingredient as the source of calcium for the shell of the eggs. Despite the abundance of coconuts in the Philippines, the students

producing eggs were using the freshly grated coconut meat sparingly in feeding it to their layers. Four students fed back the egg shells to the birds by mixing them in a ground form with the basal ration.

TABLE I

NUMBER OF STUDENTS USING FEED INGREDIENTS IN FEEDING THEIR POULTRY

Feed Ingredients	Number of Students Using Feed Ingredients for Laying Ration	Fattening Ration
Aurofac	4	0
Bone meal	2	0
Cod liver oil	4	0
Commercial ready-mixed feed	20	0
Copra meal	83	11
Corn (whole and ground)	99	38
Cowpeas, ground	3	1
Dried whey	7	0
Egg shell, ground	4	0
Fish meal	108	11
Grass, freshly cut	29	12
Grated fresh coconut	2	34
Ipil-Ipil leaf meal	17	2
Limestone	10	0
Mungo	15	10
Oyster shell, ground	25	0
Rice bran, fine	96	18
Rough rice (palay)	14	12
Salt (NaCl)	21	0
Sea shell, ground (buguitis)	44	0
Shrimp meal	44	7
Sorghum	3	0
Total number of students having poultry enterprises	124	

It is the policy of all the vocational agriculture schools in the Philippines to include an organized plan for teaching poultry and livestock feeding from the first to the fourth year in vocational agriculture, although the fourth year students deal mostly with the

processing of feeds for poultry and livestock. From the standpoint of taking advantage of a good learning situation, the first two years of studies in vocational agriculture probably constitute the best time for teaching poultry feeding since a great interest is held on by the students as they start to develop their own feeding programs.

As shown in Table II, the mean and median scores of the 201 junior and senior students of vocational agriculture in seven schools fall at the upper limit of the scores ranging from 56 to 60. It is interesting to note that only four per cent of the students got scores ranging from 56 to 60.

TABLE II

DISTRIBUTION OF SCORES OF ALL JUNIOR AND SENIOR STUDENTS OF VOCATIONAL AGRICULTURE
(Highest Possible Score, 100)

Score	Frequency	
	Number	Per Cent
11-15	2	1.0
16-20	2	1.0
21-25	5	2.5
26-30	12	6.0
31-35	10	5.0
36-40	13	6.4
41-45	12	6.0
46-50	16	8.0
51-55	21	10.4
56-60	8	4.0
61-65	13	6.4
66-70	7	3.5
71-75	15	7.5
76-80	20	9.9
81-85	8	4.0
86-90	31	15.4
91-95	4	2.0
96-100	2	1.0
Totals	201	100.0
Median Score	60.19	
Mean Score	60.24	

Figure 2 is designed to graphically provide for a frequency distribution of test scores of 201 students as based on Table II. This graph indicates the lower one half of the frequency distribution which made a gradual rise of the score frequencies ranging from 11 through 55 and went down to 60. It can be seen from the graph that the deviations above the mean as represented by the sudden rise and fall of the frequency distribution equals almost the sum of the deviations below the mean as indicated by the gradual rise of the frequency of the scores. As shown in Table II, the mean individual score is almost the same as the median individual student score with a difference of 0.05. If one sees the graph in haste without analyzing it properly, he is likely to conclude that the frequency distribution is skewed to the left, but that is not true as previously explained by the writer. Table II indicates that 15.4 per cent of the students made scores ranging from 86 to 90.

Individual test scores by students ranged from 12 to 96. The highest scoring individuals were a boy and a girl both having animal projects at home. The boy in his supervised farm training program had four swine, 30 chickens, 10 ducks, and three turkeys. He fed his chickens with a commercial feed in confinement while he raised his ducks and turkeys on a free range being fed with corn and freshly grated coconut. The student with the lowest score was a boy who had corn, two work caraboas, two swine, and a dozen chickens for his productive enterprises. It should be recognized that a portion of the low scores could be due to a low level of intelligence. It can be noted as shown in Table II that there were only two students who obtained scores ranging from 11 to 15.

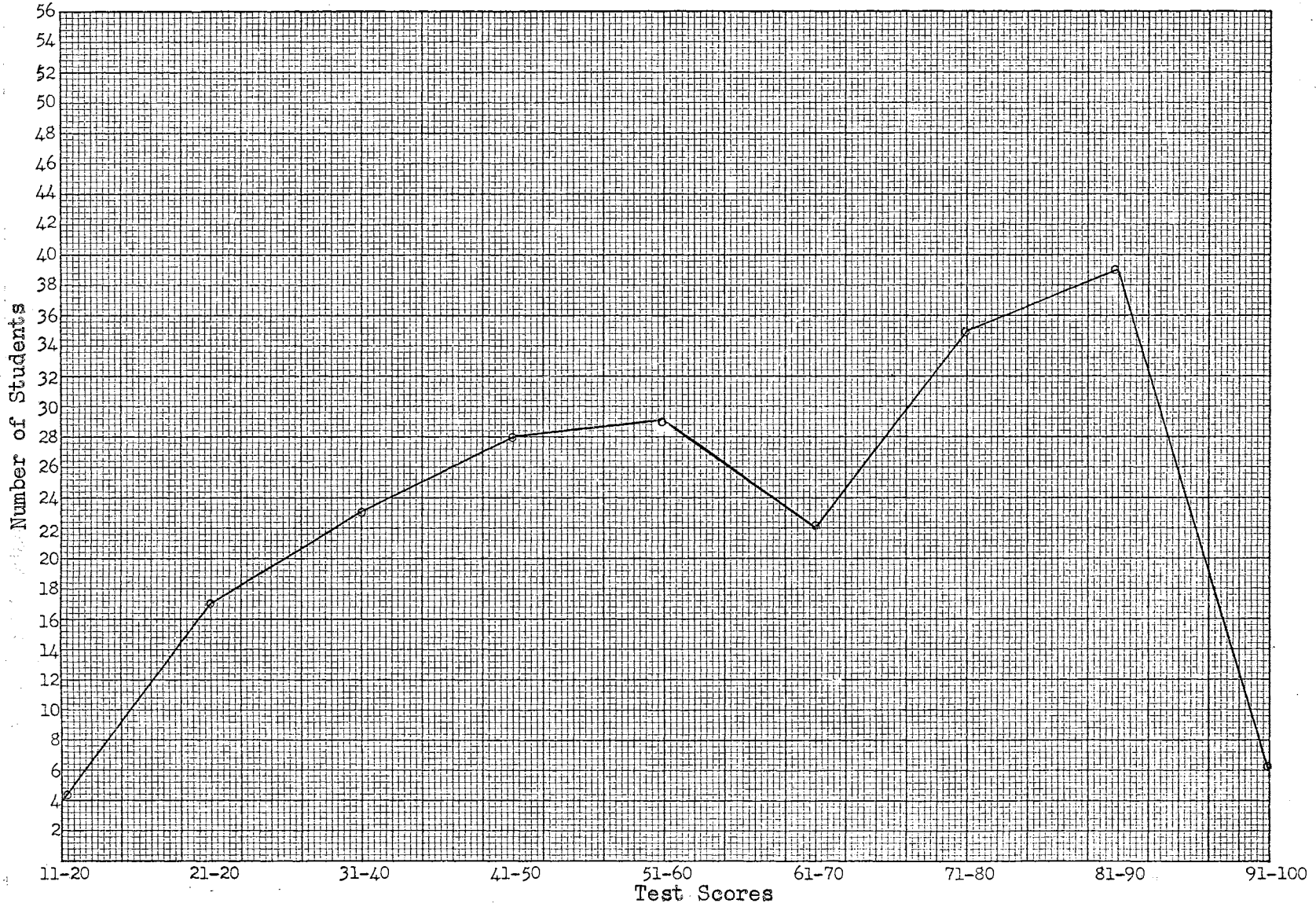

Figure 2. Frequency Distribution of Test Scores Made by 201 Third and Fourth Year Students of Vocational Agriculture Attending Seven Schools in the Philippines.

The highest scoring female individual, who obtained a score of 96, in her supervised farm training program had two swine, 12 ducks, and 23 chickens. She mentioned that she fed her fowls with corn and palay. It could be assumed that she raised her fowls on a free range allowing them to feed on insects and seeds of weeds as sources of protein. An individual benefits little from the study of poultry feeding if information gained from the school is not carried over in the management of poultry projects. It is possible that there was little follow-up of the instruction made by the teacher from the school to the student's home projects.

Table III presents mean scores per school to vary from 33.00 to 85.25. Students in one school made an exceptionally low mean score which would likely indicate a lack of organized instruction in poultry and livestock feeding .

TABLE III

MEAN AND MEDIAN STUDENT TEST SCORES ON POULTRY FEEDING PRACTICES AS DETERMINED BY SCHOOLS

School	Number of Students	Mean Score	Median Score
G	33	33.00	33.00
F	29	55.60	54.00
D	33	56.33	53.94
B	32	57.50	55.50
E	16	63.90	60.50
C	30	79.10	79.25
A	28	85.25	87.50

Mean Individual Student Score	60.24
Median Individual Student Score	60.19

While there was no attempt made in this study to determine the learning abilities and aptitudes of the students, a comparison in test scores between the 150 boys and 51 girls was ascertained. The mean

TABLE IV

MEAN AND MEDIAN STUDENT TEST SCORES ON POULTRY FEEDING PRACTICES AS DETERMINED BY BOY AND GIRL STUDENTS

Student	Number of Students	Mean Score	Median Score
Girls	51	67.90	69.88
Boys	150	57.57	54.83
Mean Individual Student Score		60.24	
Median Individual Student Score		60.19	

score difference between the two groups is 10.33 which is highly significant. It can be concluded that the girls have more stimulated interests in applying the principles of poultry feeding as they are so attached to the home where poultry could be well attended by them. This condition which produces a high degree of interest creates a favorable situation for developing and sustaining learning.

There was one school that conducted the test to seventeen girls and thirteen boys. By following the procedure as to the selection of students to accomplish the questionnaires, then it can be said that there are rural schools having more girls than boys enrolled. It was noted that girls who took the test had more poultry projects than livestock.

The completion questions were of a technical nature and required more ability to recall than did other portions of the test. Scores made on this type of questions, as indicated in Table V, ranged from zero to twenty-four.

TABLE V

DISTRIBUTION OF TEST SCORES OF STUDENTS ON COMPLETION QUESTIONS ON FEED NUTRIENTS
(Highest Possible Score, 24)

Score	Frequency	
	Number	Per Cent
0-2	13	6.4
3-4	11	5.4
5-6	17	8.4
7-8	9	4.5
9-10	17	8.4
11-12	21	10.5
13-14	8	4.0
15-16	19	9.5
17-18	22	11.0
19-20	23	11.4
21-22	34	17.0
23-24	7	3.5
Totals	201	100.0
Median Score	14.98	

Of this group, question number one was missed by thirty-nine students of the 201 students. Twenty of the 33 students in one school who accomplished the examination failed to write the correct answers to the question. The list of the six feed nutrients that must be supplied are usually discussed in an animal feeding class in vocational agriculture before the students could be ready to classify any feedstuff according

to its nutritive value. It can be safely said that there was no sufficient time allowed for the students to study the six feed nutrients so that transfer of learning could take place.

The number four question which asked for the average annual feed consumption of a White Leghorn layer could have been answered so easily if students having supervised poultry projects had ever kept records properly. Some students made wild guesses from 85 to 277 kilograms of feed as the annual consumption of a White Leghorn layer. Most of those who never gave the right or nearest to the expected answer were students who had no poultry projects of their own.

The question answered correctly by most students is number six, which asked what the symbols "D.P." and "T.D.N." stand for when referring to feeds. This question was missed by 32 students. The number of students that missed this question is correlated with that of those who unsuccessfully answered question number one. It is possible and safe to conclude that the students who failed in the first question could be the same individuals who flunked in the sixth. This finding suggests that it is quite difficult for these 32 students to understand and generalize the terms necessary for compounding rations.

Table VI reveals that thirty-nine students, which is 19.4 per cent of the 201 students, were able to differentiate twelve or more feeds which are protein supplements and those which are energy feeds. The median score of 23.98 falls on the upper limit of the test scores ranging from 21 to 24 where the greatest frequency is shown in Table VI.

Corn was misplaced as a protein supplement 66 times for the highest number of incorrect answers, while palay and rice shorts were properly chosen as energy feeds by students more often than any other feed.

TABLE VI

DISTRIBUTION OF TEST SCORES OF STUDENTS ON THE GROUPING OF FEEDS ACCORDING TO PROTEIN CONTENT
(Highest Possible Score, 28)

Score	Frequency	
	Number	Per Cent
0-4	6	3.0
5-8	7	3.5
9-12	7	3.5
13-16	22	11.0
17-20	45	22.3
21-24	75	37.3
25-28	39	19.4
Totals	201	100.0
Median Score	23.98	

Of the protein feeds, ipil-ipil meal was written in a wrong column 48 times. Had the students generalized the fact that legumes are rich in plant protein, then it could have been so easy for most of the 48 students to classify ipil-ipil meal as a protein supplement. Sorghum which is rarely grown, although it can be successfully produced, in the Philippines was wrongly identified 48 times. Corn bran was placed in a wrong group 52 times.

It is interesting to note that six students from two schools insisted writing "rice brand" for the feed "rice bran", despite the fact that names of feeds were written in the feed selection test. This kind of a mistake calls for the attention of teachers to have adequate time for blackboard work. It is very possible that the students learned the proper terms used through hearing.

Table VII indicates that 12.46 is the median score which falls between the upper limit of the test scores ranging from nine to twelve and the lower limit of the scores ranging from 13 to 16. The greatest frequency is seen between the scores of nine and twelve.

TABLE VII

DISTRIBUTION OF TEST SCORES OF STUDENTS IN MULTIPLE CHOICE QUESTIONS ON RATIONS AND FEEDS
(Highest Possible Score, 20)

Score	Frequency	
	Number	Per Cent
0-4	3	1.5
5-8	35	17.4
9-12	63	31.3
13-16	55	27.4
17-20	45	22.4
Totals	201	100.0
Median Score	12.46	

Of the multiple choice questions, question number nine was wrongly answered 142 times for the highest number of mistakes. This question was - "Green grass is a good source of riboflavin which prevents (a) simple colds, (b) perosis, (c) rickets, (d) curled toe paralysis." It is probable that many of the students failed to answer this question correctly because they had not observed these nutritional diseases in their birds, or they must have raised their birds on free range so that it is almost impossible for the birds to manifest any of these diseases.

Considering the answers given by about half of the students, it is difficult to understand why they insisted on selecting either soybean

oil meal, copra meal, or mungo as a protein feedstuff derived from an animal origin. The reason, perhaps, that they did not choose tankage as the right answer is because they do not really know what tankage means.

The fact that there were only 20 students who indicated that they were using commercial feeds, the students should know how to properly compute balanced rations for their fowls. In Table VIII, it is shown the number of students who solved the problems correctly, incorrectly, or made no attempt to solve the arithmetic problems.

TABLE VIII

NUMBER OF STUDENTS WHO SOLVED PROBLEMS CORRECTLY, INCORRECTLY, OR MADE NO ATTEMPT TO SOLVE PROBLEMS ON THE TEST

Number of Problem	Student Responses					
	Correct		Incorrect		No Attempt	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
1	85	42.3	69	34.4	47	23.3
2	59	29.3	123	61.2	19	9.5
3	91	45.3	79	39.3	31	15.4

The first problem was stated as follows: A farmer wants to buy a protein supplement for his laying flock. He can buy a local fish meal containing 65 per cent protein for $45.00 per 100 kilograms, or a commercial protein supplement containing 63 per cent protein for $40.00 per 100 kilograms. Which supplement is the best buy?

In trying to solve this problem, the students should have figured the price per kilogram of protein in each feed. Twenty-three per cent of the students made no attempt to solve the problem, and of the 77 per cent that did try it, only 42 per cent got the correct answer. Student

responses to this problem would seem to indicate that more than half of the number of the students have little concept of the basis for selecting the most economical feed.

The percent of students who made no attempt to solve this kind of arithmetic problem is less than half of that investigated in central Oklahoma by Douglas Morris.[1]

The second problem was a simple percentage problem, but appeared to be the hardest as shown in Table VIII, requiring abilities or skills commonly used in computing feed mixtures. Of the 90.5 per cent that attempted to solve it, only 29.3 per cent got the correct answer. The more common errors made by students were the addition of the percentage of protein of the feeds without obtaining the total percentage of protein of each feed by multiplying the number of feed with its protein content in per cent, and divided this total by the number of feeds used in the mixture. Improper placing of the decimal point was the most common mistake committed by students.

The third problem was the easiest of the three to solve as revealed in Table VIII. Forty-five per cent of the students figured the correct answer while 31 per cent made no attempt to solve the problem. The problem was given as follows: "For fattening capons, 85 kilograms of rough rice (palay) is worth 100 kilograms of corn. With rough rice selling at $20.00 per 100 kilograms, how much could a farmer afford to pay per 100 kilograms for corn?" The simple solution required was to multiply $.20, the cost of one kilogram of palay, by 85. Those who failed to get the right answer seemingly had little of the arithmetic reasoning needed to solve the problem.

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[1]Douglas Morris, (unpub. thesis, Oklahoma State University, 1957).

Problem three was worked out algebraically by one hundred thirty-seven students, but only 56 solved it correctly. Thirty-five students managed to get the right answer by using their knowledge in mathematics.

Table IX presents some findings which suggest possible relationships existing between mathematical courses completed by vocational agriculture students and their degree of skill in correctly solving problems related to poultry feeding. A higher percentage of students who had completed studies in algebra, applied arithmetic, and general mathematics made scores in the upper quartiles on arithmetic problems. These findings agree with that of Morris.[2]

If one analyzes Table IX carefully, he sees that students who studied either general mathematics, applied arithmetic, or applied arithmetic and general mathematics failed to achieve scores in the upper quartiles on arithmetic problems. Twenty per cent of the students who took algebra; twenty-nine per cent of those who had knowledge in algebra and general mathematics; about thirty-five per cent of those who studied algebra and applied arithmetic; and about forty-six per cent of the students who completed courses in algebra, applied arithmetic, and general mathematics scored in the upper quartiles. This proves how much a competent knowledge of algebra contributed to the students' understandings and abilities in solving problems commonly confronting poultry farmers. Attention should be called to the fact that students who exhibited a competent knowledge of algebra used shorter and more efficient methods in obtaining their answers to feeding problems.

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[2]Ibid, p. 26.

TABLE IX

MATHEMATICAL COURSES TAKEN, AND THE PER CENT OF STUDENTS WHO MADE GRADES IN THE UPPER QUARTILES ON ARITHMETIC PROBLEMS

Mathematical Courses	Number of Students Who Had Taken Course	Per cent of Students in Upper Quartiles on Arithmetic Problems
Algebra	99	20.2
General Mathematics	7	00.0
Applied Arithmetic	1	00.0
Algebra and General Mathematics	45	28.9
Algebra and Applied Arithmetic	35	34.5
Applied Arithmetic and General Mathematics	3	00.0
Algebra and Applied Arithmetic and General Mathematics	11	45.5
Total	201	

Findings pertaining to the possible inability of students to solve simple arithmetic problems appears to be in rather close agreement with the results of an investigation made by Stamps.[3]

The results obtained in this study as shown in Table IX would tend to imply that teachers in algebra, general mathematics, applied arithmetic, along with teachers of vocational agriculture, should spend more time teaching students to understand and solve arithmetic problems realted to farming. The fact that all courses taught in vocational agriculture are supposedly related subjects, certainly it implies that the teachers of these said subjects should bring down the setting of their arithmetic problems to the students' actual farming situations. The writer believes that with this method of interest approach the students would obtain a continuous, stimulating interest in understanding factual problems. The teacher should not forget that the level of the students' understanding should be sought for to meet a lively teaching-learning situation.

Data presented in Table X shows the number of students having poultry and livestock enterprises together with the distribution of test scores, means, and differences in terms of the nature and extent of the productive projects of students. The test was designed and prepared with the intention of giving more emphasis to poultry feeding than to livestock feeding, although the feeding principles involved are similar. From the mean test scores achieved by individual students comprising groups one and two, there was no significant difference. This would tend to indicate that students having poultry and other animal projects combined and those students with poultry projects alone, are of equal ability in developing concepts related to poultry feeding.

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[3]Stamps, (Unpub. Master's non-thesis study, 1952).

TABLE X

DISTRIBUTION OF TEST SCORES, MEANS, AND DIFFERENCES IN TERMS OF THE NATURE AND EXTENT OF THE PRODUCTIVE PROJECTS OF STUDENTS

Test Scores	Number of Students Having Poultry and Livestock Enterprises		
	Group 1 Poultry only (Including Chickens, ducks, geese, and turkeys)	Group 2 Poultry and Other animal Enterprises	Group 3 Animal Enterprises (Excluding poultry)
11-15	0	1	0
16-20	0	1	0
21-25	0	3	0
26-30	3	13	0
31-35	1	4	0
36-40	3	3	1
41-45	2	9	1
46-50	3	10	0
51-55	0	9	1
56-60	5	6	2
61-65	0	3	1
66-70	2	5	1
71-75	1	7	3
76-80	3	7	2
81-85	2	6	0
86-90	3	8	1
91-95	0	0	0
96-100	0	1	0
Totals	28	96	13
Mean score by enterprise	58.00	55.87	64.92

Difference between groups one and two	2.13
Difference between groups one and three	6.92
Difference between groups two and three	9.05*

The mean score for students having animal enterprises, excluding poultry projects, was the highest of the groups listed in Table X. The mean score for this group was 64.92. The mean score of group three suggests that students engaged in animal enterprises excluding poultry could make a successful venture in scientific poultry feeding.

Table XI shows the number of students having poultry enterprises together with the distribution of test scores, means, and differences in terms of the nature and extent of the poultry projects of students. The mean score of group one, students having chickens only, was 56.55 while that of group three was 54.36. These two groups gave no significant difference in their mean scores. This result offers a suggestion that individuals engaged in chicken projects will find no difficulty in raising other species of poultry like ducks, geese, and turkeys.

Comparing group two, students having chickens and ducks, with groups one and three, the difference of their mean scores is so highly significant that this finding will present evidence that poultry raisers who limit the kinds or species of poultry in their projects to two very similar types of enterprise are also those individuals who have better concepts in understanding poultry feeding.

Table XI reveals that there were only 23 students who had chickens and ducks as their poultry enterprises. They, as a group, obtained the highest mean score of 69.52 of the three groups. The results indicate that students with a better understanding of the basic concepts of poultry feeding are not contented of raising one kind of poultry nor more than two species. Consideration should be given to the fact that emphasis on duck raising was quite apparent in the second group although chickens were also raised. Only a few number of poultry raisers in the

TABLE XI

DISTRIBUTION OF TEST SCORES, MEANS, AND DIFFERENCES IN TERMS OF THE NATURE AND EXTENT OF THE POULTRY PROJECTS OF STUDENTS

Test Scores	Number of Students Having Poultry Enterprises		
	Group 1 Chickens only	Group 2 Chickens and ducks only	Group 3 Chickens, Ducks and other poultry enterprises (turkeys and geese)
11-15	1	0	0
16-20	0	0	0
21-25	4	0	1
26-30	11	0	1
31-35	4	0	1
36-40	6	0	0
41-45	5	2	0
46-50	10	2	1
51-55	8	4	1
56-60	3	0	1
61-65	7	1	2
66-70	1	3	0
71-75	4	1	2
76-80	9	3	0
81-85	3	0	1
86-90	14	5	0
91-95	0	1	0
96-100	0	1	0
Totals	90	23	11
Mean score by enterprise	56.55	69.52	54.36

Difference between groups one and two	12.97*
Difference between groups one and three	2.19
Difference between groups two and three	15.16**

Philippines engage in duck raising. Unlike chickens, ducks can be raised profitably in places where there are large bodies of fresh water. Fresh snails[4], including their meat and shells, gathered from the bottom of rivers and lakes serve as an excellent source of animal protein for laying ducks. Duck raisers generally feed their laying ducks with palay morning and afternoon, and they are allowed access to a pile of snails at all times during the day. In places where fresh snails are not abundant, duck raisers find it necessary to feed their layers in a manner similar to the feeding of chickens. This, then, may be suggested as a practice where a few attaining a thorough knowledge of poultry feeding, should perhaps venture in the raising of ducks together with chickens.

Records shown in Table XII tend to indicate that differences do exist in basic concepts of poultry feeding acquired by students having poultry and livestock enterprises as compared to those students owning crop projects or having crop and animal enterprises.

Test scores from groups one and three were subjected to t test to ascertain if differences in mean scores were significant enough to draw any comprehensive conclusion. The t value obtained was 2.70. Reference to the table of t indicates the required value at one per cent level, with 48 degrees of freedom, to be 2.68. Since the obtained value of 2.70, with 48 degrees of freedom, is above that required to reject the hypothesis that no significant differences exist between groups one and three, then the difference of 15.57 in mean scores is highly significant. It is possible to conclude, basing from the findings, that students having supervised farm training experiences in the feeding

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[4]"Susong papang" (Paludina angularis)

TABLE XII

DISTRIBUTION OF TEST SCORES, MEANS, AND DIFFERENCES IN TERMS OF THE NATURE AND EXTENT OF THE PRODUCTIVE PROJECTS OF STUDENTS

Test Scores	Number of Students Having Enterprises			
	Group 1 Only animal enterprises	Group 2 Crop and animal enterprises	Group 3 Only crop enterprises	Group 4 No Productive enterprises
11-15	0	1	1	0
16-20	0	1	2	0
21-25	0	3	0	0
26-30	2	12	0	1
31-35	0	7	0	2
36-40	1	6	3	4
41-45	1	10	2	1
46-50	1	13	5	2
51-55	1	10	5	2
56-60	1	8	0	0
61-65	1	6	2	2
66-70	2	4	1	0
71-75	5	7	3	3
76-80	2	12	0	2
81-85	1	8	2	1
86-90	2	10	1	9
91-95	1	0	0	3
96-100	2	0	0	0
Totals	23	119	27	32
Mean score by enterprise	68.20	55.40	52.63	66.75

Difference between groups one and two	12.80*
Difference between groups one and three	15.57**
Difference between groups two and three	2.77
Difference between groups two and four	11.35*
Difference between groups three and four	14.12*
Difference between groups one and four	1.45

of poultry and livestock, in general, acquired clearer understandings of the basic concepts in this specific phase of learning in vocational agriculture.

Group four with a mean score of 66.75, having a difference of 1.45 with that of group one, is interesting to note. Students enrolled in agricultural and rural schools in the Philippines may acquire different experiences in vocational agriculture by working in directed projects of the school and/or having his own supervised farm projects. Those students, therefore, having no productive projects are allowed to work under a teacher in directed projects. It is true that they may learn many things from such kind of enterprises, but it is doubtful if every student sustains a desirable degree of interest. Working in directed projects does not always encourage the students to develop inherent virtues so that they could create their own jobs when they step out of school or while schooling. Such kinds of training may lead a student to work always under somebody's direction; thus, it can be a preparatory course to tenancy type jobs.

The writer believes that further studies are needed for similar or related investigations in the future before very comprehensive conclusions could be formed.

CHAPTER IV

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

It is the aim of this chapter to paraphrase the purposes of the problem, reexamine the method of study and investigation, summarize conclusions reached, and to propose implications and recommendations shown by the results of the investigation.

Purpose of the Study

The main purpose of this study was to consider one aspect or area of learning in vocational agriculture, the feeding of poultry, and to discover some of the understandings students of vocational agriculture acquire. A related purpose was to ascertain the degree of interest of the girl students as well as boys in vocational agriculture schools pertaining to their supervised farming programs. A questionnaire which was included in the test given to the students was prepared with the purpose of discovering if significant differences occur in basic understandings acquired related to poultry feeding practices between groups of students who have been feeding their poultry in directed projects. To determine the extent of the ability of vocational agriculture students to solve arithmetic problems concerning the feeding of poultry was also included as one of the related purposes of this study.

Design and Method of Investigation

Since it was impossible for the writer to personally conduct the investigation in different agricultural and rural schools pinpointed for the study, a test including a questionnaire on poultry feeding was planned and prepared to determine the concepts relevant to poultry feeding problems existing in the Philippines. A set of questions was prepared to acquire information concerning the poultry feeding experiences which students have had, to find out the kinds of feeds the students used in preparing the fattening and laying rations, to obtain a list of the crop and animal enterprises the students have in their vocational agriculture, and to determine courses in mathematics completed by the students.

As soon as the principal or superintendent of the school received the test with the questionnaire, a committee of two or three vocational agriculture teachers was assigned to conduct the examination. To avoid biased selection of students to accomplish the test, a procedure was followed in such a way that the picking of students was randomized from the class register.

Conclusions Reached Concerning the Problem

A frequency distribution graph was made to determine the frequency curve of the 201 students who took the examination from the seven schools. The responses of the students to the test was so widely varied that it resulted in a fluctuating frequency distribution curve. In those schools where the frequency distribution of the test scores fell so low, it indicates that in some cases, there exists a deficiency of organized instruction, especially in the field of approved poultry

feeding practices. It is very evident that very little follow-up and guidance were given in utilizing a knowledge of poultry feeding to student supervised farm programs.

There were fourteen students out of thirty-three who took the test who did not know the difference between supervised farm projects and directed projects. The fact that they did not have their own supervised projects, they listed all the directed projects of the school. While directed projects serve as the training ground for students who could not afford to run their own projects due to lack of capital, on the other hand, this type of supervised farm training tends to discourage independence of thinking and inhibit retention of a high degree of interest in agriculture. It may tend to destroy the initiative of possessing their own things and discourage the achievement of a sense of ownership responsibility.

There is no substitute or short cut to successful egg production through scientific poultry feeding. Students who are not trained properly in the computation of rations would likely not succeed in their poultry enterprises if they were to prepare and mix the feeds. While it is true that the majority of the students know the six feed nutrients and the meaning of the symbols, "D.P." and "T.D.N.", only twenty-nine per cent of the students could determine the total percentage of protein correctly. Corn, which is widely known as an energy feed, was often misplaced by the students as a protein feed. Perhaps this suggests that there was misdirected or insufficient emphasis in organizing the teaching plan for poultry feeding.

Students were found to have great difficulty in understanding and figuring the solutions to simple arithmetic problems pertaining to poultry feeding. These findings reveal that attention of the teachers of algebra, general mathematics, applied arithmetic, and vocational agriculture should be so applied as to provide for student acquisition of need skills and guidance in the application of mathematical skills to the working out of actual farming problems in supervised farm programs. An interesting result of this investigation is the positive indication of the role of algebra in increasing the rate of understanding problem solving. Students who completed only either applied arithmetic or general mathematics did not achieve high scores in solving arithmetic problems, but with those students having knowledge in algebra made scores in the upper quartiles, and even much better scores were achieved in the upper quartiles by students who studied algebra plus either applied arithmetic or general mathematics.

The finding of this study that girls have better concepts in poultry feeding than boys should not be ignored. It is a recognized fact that girls are more closely concerned with the home where poultry can be well attended by them. This may well be an influencing factor stimulating interest in applying poultry feeding principles.

Students with more adequate supervised farm training programs which included poultry and other animal enterprises proved to have definitely acquired clearer concepts of poultry feeding than did those having only crop enterprises or a combination of crop with few animal enterprises. Students having no productive enterprises of their own also did obtain clear concepts of poultry feeding. This can be

explained, perhaps, by the fact that agricultural or rural schools in the Philippines have a school program of directed projects where labor is performed by the students. While ownership and full management of projects are not provided for to this group of students, there is some opportunity for pride of accomplishment to develop when individually assigned projects are successful. Even though these students do often acquire desired concepts and skills, it is not surprising to see graduates seeking jobs not related directly to agriculture since these students were trained as student laborers rather than as operators.

Implication from the Study

Certain implications formed in this study may deserve merit of some consideration.

Findings obtained in this study have indicated conclusively that actual feeding experiences gained by students are of considerable value to them in developing clearer understandings concerning poultry feeding. Every phase or field of vocational agriculture taught requires sufficient teacher planning and preparation in order for students to acquire learnings through genuine farm experiences which develop and sustain a high degree of interest and are responsible for the acquisition of more permanent learning.

The majority of the girl students owned more poultry enterprises than other animal enterprises as shown by the fact that they are so attached to the home and they could very well take care of the poultry. The significant difference between the test scores of the boys and girls, in favor of the latter, perhaps implies that girls maintain a great interest through owning supervised poultry enterprises.

Recommendations

As based from the results of this investigation the following recommendations are enumerated:

1. That teachers of vocational agriculture make an effort to assist the students, boys and girls, in the development of comprehensive farm training programs through continuous application of guidance and follow-up efforts. This will assure a high degree of interest as brought about by pride of ownership and achievement in successful management of productive enterprise projects in poultry production.
2. That teachers encourage all students enrolled in vocational agriculture to have their own supervised productive enterprises and minimize the employment of students in totally school owned and directed projects.
3. That teachers in applied arithmetic, general mathematics, algebra, and vocational agriculture agree to put more time in directing students solving problems pertaining to supervised farm training programs and actual farming situations.
4. That teachers prepare comprehensive plans for the organized teaching of animal feeding, giving special attention to methods and teaching devices which will insure student ability to transfer learning from one problem or problem area to another.
5. That teachers initiate a practical demonstration program involving the proper mixing of poultry feeds utilizing the

available feedstuffs in the locality; thus, in turn encouraging the students to be resourceful. Students should be involved in all phases of this program - (1) planning, (2) initiating, and (3) application.

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APPENDIXES

APPENDIX A

TEST ON POULTRY FEEDING

Student's name_____

The purpose of this test is to secure information concerning student's learning and understanding of poultry feeding.

Poultry Feeding Test

Directions: Answer each of the following questions according to the feeding systems used on your farm.

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1. Are chickens for egg production raised on your farm? Yes___ No___. If yes, list the feeds included in the laying ration.
2. Are capons raised on your farm? Yes___ No___. If yes, list the feeds included in the fattening ration.
3. List the kinds of protein feeds which are bought and fed to poultry on your farm:
4. What minerals are incorporated in the ration for feeding poultry on your farm?
5. List the crop and animal projects you have in vocational agriculture:
6. If you have animal projects in your supervised projects, give the number of animals and list the feeds you give to each kind of animal.

	Number	List of feeds fed
Dairy cattle	_____	_____
Beef cattle	_____	_____
Dairy carabaos	_____	_____
Work carabaos	_____	_____
Swine	_____	_____

	Number	List of feeds fed
Goats	_____	_____
Sheep	_____	_____
Poultry:		
Chickens	_____	_____
Ducks	_____	_____
Turkeys	_____	_____
Geese	_____	_____

7. Check each of these courses you have taken in high school.

_____ General Mathematics _____ Applied Arithmetic

_____ Algebra

Directions: Read the following statements carefully and fill in the blank space or spaces in each statement that would make the statement true and complete.

1. List the six feed nutrients that must be supplied to animals:

(1 _____ (2 _____ (3 _____

(4 _____ (5 _____ (6 _____

2. What is the precursor or inactive form of vitamin A in plants? _____

3. Which vitamin is called the sunshine vitamin? _____

4. What is the average annual feed consumption of a White Leghorn layer (express in kilograms)? _____

5. What is the percentage of protein content in a laying ration? _____

6. When referring to feeds, the letters "D.P." stand for _____ _____ and the letters "T.D.N." stand for _____ _____ _____.

7. The feed nutrient that produces growth, builds muscular tissues and vital organs is _____.

8. The mineral that is mainly found in oyster shell or limestone which is given to chickens to form the egg shell is _____.

9. The two minerals that principally build the bones are _____ and _____.

10. The class of feeds that are high in fiber and low in T.D.N. are called _____.

11. The class of feeds that are low in fiber and high in T.D.N. are called _____.

12. A farmer wants to buy a protein supplement for his laying flock. He can buy a local fish meal containing 65 per cent protein for $45.00 per 100 kilograms, or a commercial protein supplement containing 63 per cent protein for $40.00 per 100 kilograms. Which supplement is the best buy? (Show all your work and circle your answer).

Directions: Listed below are feeds commonly fed in the Philippines. Regroup these feeds into two separate lists in the blanks by placing all those which are high in protein in the first column and those low in protein in the second column.

	High Protein Feeds	Low Protein Feeds
corn		
rough rice (palay)		
rice bran		
soybean meal		
fish meal		
copra meal		
ipil-ipil meal		
rice shorts		
shrimp meal		
mungo		
corn bran		
dried skimmilk		
sorghum		
cowpea		

Listed below is a concentrate mixture. The kilograms of each feed and the protein percentage of each feed is given. What is the percentage of protein in the whole concentrate mixture? (Show all your work and circle your answer).

250 kilograms rice bran, 12 per cent protein

450 kilograms corn, 9 per cent protein

200 kilograms soybean meal, 44 per cent protein

50 kilograms fish meal, 65 per cent protein

20 kilograms dried whey, 12 per cent protein

30 kilograms copra meal, 21 per cent protein

For fattening capons, 85 kilograms of rough rice (palay) is worth 100 kilograms of corn. With rough rice selling at $20.00 per 100 kilograms, how much could a farmer afford to pay per 100 kilograms for corn? (Show all your work and circle your answer).

Directions: Each of the following statements is followed by several possible answers. Only one is correct. Underline the correct answer.

1. A balanced ration means (a) all the animal will eat in 24 hours, (b) nutrients supplied in proportions to meet the animal's needs for 24 hours, (c) a limited grain ration, (d) to use home grown feeds.
2. The best source of protein for laying flock is (a) yellow corn, (b) fish meal, (c) copra meal, (d) fine rice bran.
3. The most characteristic element in proteins is (a) manganese, (b) zinc, (c) nitrogen, (d) iodine.
4. An animal deprived of (a) proteins, (b) carbohydrates, (c) fats, (d) water dies more quickly than one deprived of all other nutrients.
5. The best source of calcium is (a) salt, (b) oyster shell, (c) rice bran, (d) rock phosphate.
6. The primary purpose in keeping poultry is to transform farm feedstuffs into (a) beef and eggs, (b) meat and eggs, (c) pork and eggs, (d) cheese and eggs.
7. Young, tender, green grass supplies all of the vitamins needed by chickens except (a) vitamin D, (b) vitamin A, (c) vitamin E, (d) vitamin K.
8. An example of protein feedstuff derived from an animal origin is (a) soybean oil meal, (b) tankage, (c) copra meal, (d) mungo.
9. Green grass is good source of riboflavin which prevents (a) simple colds, (b) perosis, (c) rickets, (d) curled toe paralysis.
10. Fats have about (a) 2.25 times, (b) 6.25 times, (c) 5.25 times, (d) 7.25 times the heat-production value of carbohydrates.

APPENDIX B

EXPLANATION OF STATISTICAL COMPUTATIONS

On page 15 data were presented showing the mean scores for groups of students having various supervised farming enterprises. The following is an explanation of computation of the t test, which data from group one and group three were subjected:

Formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\Sigma X^2 - \left[\frac{(\Sigma X_1)^2}{k_1} + \frac{(\Sigma X_2)^2}{k_2}\right]}{N - 2}\left(\frac{1}{k_1} + \frac{1}{k_2}\right)}}$$

in which,

X = individual student score

X_1 = mean individual student scores for group one

X_2 = mean individual student scores for group three

k_1 = number of individual student scores in group one

k_2 = number of individual student scores in group three

N = total number of student scores

$$t = \frac{68.20 - 52.63}{\sqrt{\frac{200,685 - \left[\frac{2,446,096}{23} + \frac{2,019,221}{27}\right]}{50-2}\left(\frac{1}{23} + \frac{1}{27}\right)}}$$

$$t = \frac{15.57}{\sqrt{\frac{200,685 - (106,352 + 74,786)}{48}(0.0815)}}$$

$$t = \frac{15.57}{\sqrt{\frac{200,685 - 181,138}{48}(0.0815)}}$$

$$t = \frac{15.57}{\sqrt{33.1892}}$$

$$t = \frac{15.57}{5.76}$$

$$t = 2.70$$

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