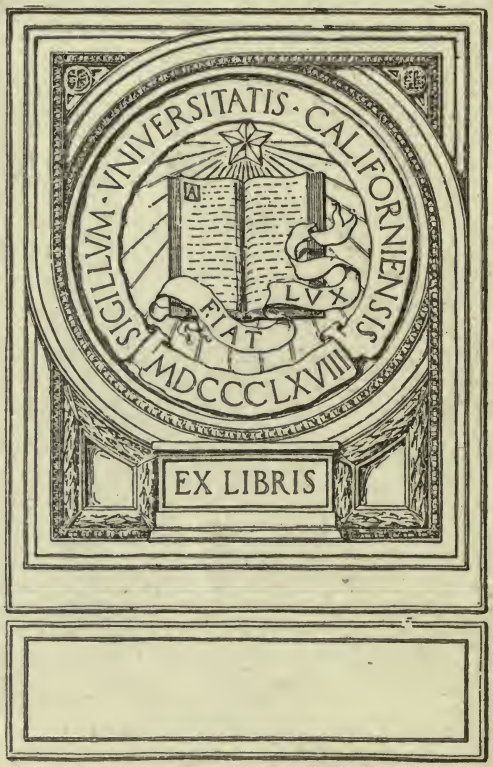
AN OBJECTIVE METHOD FOR DETERMINING CERTAIN FUNDAMENTAL PRINCIPLES IN SECONDARY AGRICULTURAL EDUCATION

EDGAR C. HIGBIE

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Philosophy, Columbia University.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INTRODUCTION

There is a tendency to distinguish somewhat sharply between general education and vocational training for farm boys. Whether this is advisable may be an open question. However, it aids in simplyfying the problem of curriculum-making in that we can decide more easily what knowledge really functions in a particular phase of instruction. Using such knowledge as a basis we can then more readily derive the necessary principles and devise the best training courses.

There is a probable advantage in distinguishing rather sharply between general education and vocational training.

The ideas of minimal essentials and job analyses are coming to be especially helpful in what they can contribute to the field of secondary agricultural instruction.[1] One cannot, however, press the study of these problems very far without realizing the importance of another line that will not permit itself to be disregarded when questions of materials and methods are under consideration. Kelly feels that nature is more important than nurture in deciding certain educational principles.[2] Educational and vocational direction have been receiving much attention in city schools and urban trades and industries, but the writer is beginning to think that "fitness for farm-

Nature as well as nurture needs consideration in educational questions.

1. They are helpful, not in determining all that should be taught but rather in aiding in the selection of the vital from the mass of available material and organizing it into problems, projects, units, etc.

2. Educational Guidance, by Truman L. Kelly, Ph. D.—Teachers College Contribution to Education, Pages 13 and 72.

ing" must be studied as well as "training for farming." Any one familiar with rural life recognizes that some men are natural-born farmers, successful even with very limited opportunities and training. They progress rapidly through the hired man, the tenant and the mortgage stages to independent ownership and wealth, as wealth goes in farming. "You just can't keep some men down" applies in this as well as in other occupations. Behind the farm management factors of size, diversity and productivity are personal qualities that may condition success and that may need consideration in curriculum-making, or boy-training, to a larger extent than has yet been recognized. So many men succeed without special training; so many fail with everything, apparently, in their favor.

Are there special qualities which tend to insure success? If there are, how can they be determined? And when known, can they be induced, developed or grafted on to the ordinary individual? Or, can they be pre-determined and become the basis for effective vocational direction? If there are definite characteristics or qualities that tend to appear in the more successful portion of the farming population, what relation have they to the selection and organization of subject matter—indeed to the whole scheme of secondary agricultural education?

It is in the hope of opening up this more or less unexplored field that the present study has been pursued. In arriving at the stage of the inquiry indicated above the following steps or questions have been considered: How shall prospective instructors be properly trained for successful agricultural teaching? The further the study of this question was carried the greater seemed the necessity for answering a second question, namely, how can basic questions in teacher-training be disposed of without more surety as to what shall be taught? This, of course, necessitates delving into the secondary agricultural subject-matter problems and here again is confusion. Secondary curricula as imitations of college curricula, or more often merely "reduced portions" of collegiate subject-matter, were far from satisfactory. What shall we teach? How

Subject-matter needs early attention in educational considerations.

shall we teach? Shall we train for general agricultural intelligence or for specific production? The further these studies were urged the more confusion seemed to result.[3] Finally, so far as subject-matter is concerned, this question presented itself: Would it be possible to determine what specific facts or principles really functioned in successful agricultural production? The answer to this is important, as the results of this study will clearly show and an outline plan for the determination of such working knowledge will be given later. Leaving for the present any further consideration of subject-matter problems, let us state the final question, already suggested and forced into the study, as being vital to the whole field. Do men tend to succeed in farming by virtue of their physical capacity, their special skills their mechanical abilities, their general education, their command of technical facts, or by virtue of a special type of intelligence conditioning ability to plan, to organize, to risk, etc? In a word would it contribute to the discussion if the type of man could be "brought into the clear" —the type that tends to succeed even with a minimum of training, and regardless, sometimes, of much preliminary experience? Would it, perhaps, help to change the focus of our teaching from that of imparting useful knowledge about soils, crops, stock and the like to that of training the boy, trying to consider and organize that training around such possible factors as management, business ability, etc? Furthermore, would it give us a basis for directing some boys into such agricultural specialties as poultry raising, truck gardening, and green house work if they appeared to lack those managerial qualities that the general farmer seems to require.

Can the type of man that tends to succeed in farming be "brought into the clear"?

3. At this point the idea of a job-analysis, applied so well by Allen to trades and industries, seemed to offer a way out of the maze and the writer would like to call attention to some excellent work being done by Kent and Williams in applying this method. He believes that they are overcoming what might be urged as an objection to the Allen idea, namely, that it applies directly to the worker in industry rather than the manager. The farm job is a complex approximating the managerial type somewhat more than even the skilled labor type of occupation.

The Successful Farmer.

The determination of the chief characteristics of the successful, all-round farmer becomes, then, the first and in some ways the most important question to be attacked. In view of the possible value of the method used in this study for determining characteristics in other types of farming, such as poultry raising, truck gardening, fruit growing, etc., or even in totally different occupations, the procedure will be given in considerable detail.[4]

The characteristics of the all-round general farmer as opposed to the specialty farmer need consideration.

The following characteristics, qualities, conditions, or abilities were chosen after considerable thought as being the most usable and valuable for study. The definitions were carefully and briefly drawn so as to obtain as clear-cut comparison as possible.[5] Each quality will be known throughout the study by the letter preceding it in the definition list. A small letter "r" with two succeeding letters in parentheses will be read as the correlation between the two items on this list that the letters represent. For example, r(fi)=.732 will mean that the correlation between financial success and native intelligence equals .732.

(i) **Native Intelligence**: Original mental ability regardless of education or special training; mental alertness, thought power.

(e) **General Education**: Schooling or education acquired either in or out of school; formal or self-education.

(n) **Agricultural Information**: Working agricultural knowledge or facts acquired by attending an agricultural school, short courses, institutes or by reading farm papers, bulletins, etc.

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4. The reader is requested to focus his attention on the method at first rather than on the results obtained. Later an attempt will be made to interpret the data as well as to justify their reliability.

5. Other qualities such as industriousness, character, nativity, etc. were taken into consideration, but the natural limits of the study prevented any further extension of the list.

(m) **Managerial Ability**: Efficiency in organizing farm work and balancing the factors of production; planning, foresight.

(k) **Field and Chore Skills**: Working to advantage as in teaming, pitching hay or bundles, shouldering sacks of grain, etc.

(c) **Mechanical Ability**: Ability to construct or repair farm tools and devices.

(b) **Business Ability**: Buying, selling, bargaining, accounting.

(p) **Physical Capacity**: Strength and endurance in the prime of life regardless of present health or age.

(u) **Unpaid Family Labor**: Free help from wife or children in the production of crops, etc.

To the above were added two others to be considered more especially as criteria.

(f) **Financial Success**: Ability to make money in producing crops, raising stock, or the like.

(v) **Community Value**: Citizenship, good living standard; substantial worth in the life of the community.

If the reader will work out a sample from his own experience like the one given in Form A, he will be in a much better mental position to understand the method and follow the later development and implications of the study.

FORM A.[6]

Names (Disguised)	Finance Success (f)	Physical Capacity (p)	Delta Differences
W. B.	13	11	minus 2
R. R.	4	4	0
G. Z.	3	3	0
T. H.	6	5	minus 1
W. W.	11	12	plus 1
A. W.	10	8	minus 2
N. S.	5	1	minus 4
R. D.	1	2	plus 1
A. K.	7	6	minus 1
H. F.	2	13	plus 11
R. T.	8	7	minus 1
S. M.	12	9	minus 3
L. V.	9	10	plus 1

SG=±14

Groups of farmers may be rated according to excellence or accomplishment.

A blank sheet of paper may be ruled roughly like Form A. In the left column the names of thirteen farmers should be written. These should be men actually (or very recently) living on farms, making their living from farming and with whom the person rating is well acquainted in their home, financial and community relationships. Reading the definition for financial success as given on page 9 choose the man who best fits the description, that is, the man who is most successful in making money by raising crops, stock, etc., and place a figure "1" after his name in the column headed "Finance Success." Then re-read the same definition and choose the man who is the least successful in this respect. Place a

6. The data used in Form A were taken from the report of a Kansas senior in Farm Management and therefore represent an actual group of farmers—men with whom this senior is well acquainted in their home, farm and community relationships.

figure "13" after his name in this same column. Next decide which man should be considered as second most successful and place a figure "2" after his name. Likewise decide who should be considered next to the least successful and place a figure "12" after his name. Continue this, working from the extremes, until the numbers "1" to "13" appear in the "Finance" column representing the numbering of the men were it possible to stand them up before one in the order of their financial success.

Follow this same procedure for "Physical Capacity" as defined. Again imagine the thirteen men to be standing in line before you. The order would be somewhat different. W. B. (See form A) e. g. would be transferred to a position two places up from the lower end of the scale. The next two men would hold their old places. T. H. would go up one place. W. W. would go down one place. N. S. leaves fifth for first place. H. F., a very successful man financially, goes to the lowest place so far as physical capacity is concerned. In spite of this one considerable change, together with several lesser ones which keep the balance. you will feel that as a whole there has not been any very decided re-arrangement. The two separate rankings of the men are not very dis-similar. This likeness, or unlikeness, as the case may be, can be measured—can be weighted and stated as a single number. The "Delta Column" gives the basis for this measurement. The positive differences must always equal the negative differences. The total of either may be known as Summation G(SG). Applying the Spearman Foot Rule Correlation formula[7] the value of this mutual relation-

The Spearman "foot rule" formula provides a simple method for obtaining desired correlations from the data at hand.

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7. $R=1-\frac{6SG}{n^2-1}$. SG in this case equals "14" and n (number of men) equals "13." $R=1-\frac{6 \times 14}{169-1}=.500$. It is customary to state the Spearman values in terms of the Pearson formula values and in this case R(fp)=.500 or r(fp)=.732. See pages 167 to 177 Thorndike's Mental and Social Measurements.

ship is found to equal .500, or in terms of Pearson's formula, .732. If there were no change in positions of the men SG would equal zero and the correlation would be perfect and equal plus 1.00. If the positions were completely reversed the correlation would approximate minus 100. If they were purely random, SG equalling 28, the correlation would be zero. This then defines the limits and determines the central point of a scale which, if stated in tenths covers twenty steps from +1.00 to —1.00.[8] The correlation r(fp)=.732 obtained above then may be conceived of as appearing well up toward the top of this scale and therefore should be considered as high in value. With this particular group of thirteen men (assuming the rankings to be perfect) the relationship between financial success in farming and physical capacity is very marked.

\+ 1.000
\+ .900
\+ .800
\+ .700*
\+ .600
\+ .500
\+ .400
\+ .300
\+ .200
\+ .100
.000
— .100
— .200
— .300
— .400
— .500
— .600
— .700
— .800
—. 900
— 1.000

Just what this correlation means may be determined by considering a question like this: "Is physical capacity as defined on page 9, a cause of financial success, as regards this particular group, or is it merely a concomitant characteristic that happens to rank high. Relationships or correlation may be high without necessarily being causal. We should scarcely say that financial success was a cause of physical capacity, yet a

8. When n=13, as a matter of fact, it is impossible to reach —1.00.

correlation is often considered both ways. Remembering that farming involves much heavy lifting like pitching hay, shouldering sacks of grain, etc. and often long hours, demanding much endurance, one is inclined to believe that physical capacity tends to be a "causal factor" in making money in farming. Just how important a factor will be discussed when more evidence is in. So far we are only asking for a clear understanding of a rather simple process for obtaining, in the form of a single arithmetical weighting, the possible relationship between such illusive (and often otherwise immeasurable) factors as the ones listed. To find the absolute correlation between financial success, e. g., and physical capacity the investigator might first need to obtain a large group of farmers whose labor incomes had been determined by the usual farm management survey methods. Then arrangements would have to be made to subject each one of these men to a physical examination, the results of which would have to be stated in the form of an index figure representing the composite findings of the test or examination. Obviously, such procedure is well nigh impossible.

Relations between characteristics or qualities may be causal or merely concomitant.

Continuing to disregard for the present any consideration of the accuracy of the ratings or the value of the relationships suggested, let us describe the further steps followed in gathering the total data.

Form B, given below, was decided upon after repeated try-outs with many groups. The data included were furnished by a senior in Farm Management in one of the Middle Western Agricultural Colleges. These, as well as all of the data from which basic conclusions are drawn, were obtained by the writer handling classes or groups of men in person at a number of universities, so that the procedure was sufficiently well standardized as to make comparisons possible. The classes were asked to follow directions "on faith" until the period was nearly over so as to prevent any attempt to guess at the desires of the investigator. There was no intimation of what was to come

out of the exercise until the main portion of the data was completed. Then a sample rating was worked out before the class and the method explained as fully as possible in the short time available. After giving the work to several hundred people and discussing many angles and questions from instructors and bodies of keen students, the writer is convinced that there were few constant errors that might seriously affect the ultimate results.[9]

Procedure was standardized and carefully guarded.

The men were seated as in a regular class or laboratory period. Each man was asked to make a list of fourteen or fifteen farmers whom he knew very well—preferably neighbors in his home community actually engaged in producing crops or stock or both for market. From this list thirteen names were finally copied in the left hand column of Form "B". After a careful reading of the definition for each column, each group was ranked for all of the columns, the completed report appearing as shown. Finally each student stated at the bottom of his report sheet that all of the men were farmers, and that he knew them very well. He also indicated the type of farming most nearly characteristic of the entire group. Reports without these statements or having material modifications were not used in the final computations.

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9. Under the later discussion of reliability certain unavoidable and perhaps not very serious weaknesses of the method will be discussed.

FORM B

Names (Disguised if you wish)	Finance Success	Native Intelligence	General Education	Agricultural Information	Management Ability	Field-Chore Skills	Mechanical Ability	Business Ability	Physical Capacity	Unpaid Labor	Community Value
W. B.	13	13	13	13	13	1	1	13	11	13	13
R. R.	4	5	1	1	5	12	6	5	4	4	5
A. Z.	3	3	3	3	3	4	3	3	3	1	1
T. H.	6	6	4	4	6	9	7	10	5	5	6
W. W.	11	11	11	11	11	11	8	11	12	10	7
A. W.	10	10	10	10	10	10	9	9	8	9	8
N. S.	5	4	6	6	4	5	11	6	1	7	9
R. D.	1	2	5	1	1	2	10	1	2	6	2
A. K.	7	7	7	7	7	6	4	8	6	3	10
H. F.	2	1	2	2	2	13.	5	2	13	8	3
R. T.	8	8	8	8	8	7	12	7	7	11	12
S. M.	12	12	12	12	12	3	2	12	9	2	4
L. V.	9	9	9	9	9	8	13	4	10	12	11

The next step in the procedure is concerned with obtaining the "Delta" columns and Summation G's for the several relationships desired. First, Financial Success, being used as a criterion, the Delta differences between it and each successive column (See Table I) are obtained from the data in Form "B". The accompanying Table II is composed of correlation coefficients as worked out from these same data. In order fully to understand the steps in what is to follow, it would be well for the reader to work these correlations through checking the results with Table II.

TABLE I.

Delta Columns from Data of Form B.[9]

f&i	f&e	f&n	f&m	f&k	f&c	f&b	f&r	f&u	f&v
0	0	0	0	—12	—12	0	—2	0	0
+1	—3	+1	+1	+8	+2	+1	0	0	+1
0	0	0	0	+1	0	0	0	—2	—2
0	—2	—2	0	+3	+1	+4	+1	—1	0
0	0	0	0	0	—3	0	+1	—1	—4
0	0	0	0	0	—1	—1	—2	—1	—2
—1	+1	+1	—1	0	+6	+1	—4	+2	+4
+1	+4	0	0	+1	+9	0	+1	+5	+1
0	0	0	0	—1	—3	+1	—1	—4	+3
—1	0	0	0	+11	+3	0	+11	+6	+1
0	0	0	0	—1	+4	—1	—1	+3	+4
0	0	0	0	—9	—10	0	—3	—10	—8
0	0	0	0	—1	+4	—5	+1	+3	+2
±2	±5	±2	±1	±24	±29	±7	±14	±19	±16

9. "f" in each case is financial success used as a criterion with such other qualities as intelligence, education, etc.

TABLE II.

Summation G's, Spearman Coefficients and Pearson Coefficients.

Relationships	S G's	R's	r's
f & i	2	.928	.995
f & e	5	.822	.965
f & n	2	.928	.995
f & m	1	.964	.998
f & k	24	.143	.242
f & c	29	—.036	—.071
f & b	7	.750	.932
f & p	14	.500	.732
f & u	19	.322	.514
f & v	16	.429	.654

As stated previously, f and i indicate the relations between financial success and native intelligence; f and e, or n etc., substitutes education or information, or the other qualities for intelligence.

Each successive column may be used as a criterion and delta differences between it and all other columns may be found. This it will be noted, makes it possible to obtain a great many inter-relationships or correlations—in the present study as many as forty or fifty will be found valuable. The symbols r(fi), r(ie), r(in), etc. will be used to indicate the correlations between (f) financial success and (i) native intelligence, between (i) native intelligence and (e) general education, between (e) general education and (n) agricultural information, etc. r(f etc.) means that financial success may be used as a criterion with all other characteristics; r(v etc.) means that community value may be similarly used with all other characteristics.

Continuing to assume that the rankings as given on the various Form B's are correct for each particular group, it is necessary to multiply the number of groups ranked many fold in order to overcome the influence of such variable factors as

size of farm, amount of capital, location, quality of soil, marketing facilities, etc. Therefore the final data used for this part of the study cover ratings of over one hundred fifty groups in several middle western states. Many more groups than this number have been rated, but the data fulfilling the requirements already stated alone have been used in the final conclusions. It may be interesting to note that, as a rule, each group represents a particular community and that these communities are widely scattered throughout a number of states. Separate studies of the correlations for each group show wide variations among the groups together with many significant and interesting peculiarities. This would be expected by any one at all familiar with farm life.

Many separate groups were rated to overcome local variations.

Since communities and groups of farmers vary to such great degrees, it is necessary to combine the results for all of the groups in each relationship. This is done by finding the median of all the correlations for each particular relationship. The r's for each summation G, however, need not be computed. Since summation G's may appear in values from 0 to 42, these may be arranged as a scale and the frequencies of the various values listed against this scale. The median of these frequencies is easily found[10] by counting in to the mid-point and noting at which summation G on the scale this appears. This summation G will give the correlation desired. This correlation is the central tendency of the relationships for all of the groups ranked. In the present study one hundred and fifty or more summation G's for each characteristic are listed from which such central tendencies are taken.

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10. See Chapters III and IV in Thorndike's Mental & Social Measurements.

SG	Frequencies	Frequencies Totaled	SG	Frequencies	Frequencies Totaled
0			23	||||| ||	7
1			24	||||| ||||| |	11
2			25	||||| ||	7
3			26	||||| ||	7
4			27	||||| ||||| |	11
5			28	|||||	5
6			29	||	2
7	|	1	30	||	2
8	|	1	31	|||	3
9	|	1	32	|	1
10	|||	3	33	|	1
11			34	|||||	5
12	|	1	35	|	1
13	||||| |	6	36	|||	3
14	|||||	5	37	|	1
15	||||| |	6	38	|	1
16	||||| |	6	39		
17	||||| |||||	10	40		
18	||||| |	6	41		
19	||||| ||||| |	11	42		
20	||||| |||	8			
21	||||| ||||| |	11			
(22)	||||| |||||	10		Total	154[11]

An illustration of this is given. The scale with the frequencies for the relationship between financial success and physical capacity appears above. Behind the particular relationship as given on Form A, page 10 were a group of thirteen Kansas farmers. The summation G=±14 for this group appears as one of the five check marks at the right of the number 14 on the scale. This summation G, representing thirteen men, is only one of the 154 summation G's, each representing separate groups of thirteen men. The mid-point of the frequencies on this scale

11. The median will be found to be at point 22 on the scale by counting down the frequencies 77 points.

is at SG 22. Substituting this value in the formula as given on page 11 and solving, r(fp) is found to equal .354. Thus behind this finally accepted total value for the relationship between financial success and physical capacity there are 154 different groups of thirteen men or 2002 different farmers scattered from Ohio to Oklahoma. In the following table (Table III) therefore, each correlation (r) should be conceived of as being the central tendency value for all of the groups rated. Moreover, as will appear later in the study, this value would probably approximate the value were 2,000,000 farmers rated instead of 2,000.

TABLE III.

Total Correlation—General Farming

	(f) Financial Success	(i) Native Intelligence	(e) General Education	(n) Agricultural Information	(m) Managerial Ability	(k) Field and Chore Skill	(c) Mechanical Ability	(b) Business Ability	(p) Physical Capacity	(u) Free Labor	(v) Community Value
(f) Financial Success		.732	.514	.700	.848	.677	.472	.801	.354	.192	.587
(v) Community Value	.587	.709	.654	.700	.606	.514	.414	.606	.217		
(i) Native Intelligence	.732		.732	.732	.772	.806	.514	.752	.307		.709
(e) General Education	.514	.732		.801	.606	.414	.414	.606	.071		.654
(m) Managerial Ability	.848	.773	.606	.772		.700	.514	.801	.354		.606
(n) Agricultural Information	.700	.732	.801		.772	.587		.732			.700
(k) Field and Chore Skills	.677	.606	.414	.587	.700		.654	.654	.567		.514
(c) Mechanical Ability	.472	.514	.414		.514	.654			.354		.414
(b) Business Ability	.801	.752	.606	.732	.801	.654					.606
(p) Physical Capacity	.354	.307	.071		.354	.567	.354			.000	.217

Preliminary Interpretations.

Ability to make money, financial success in farming, will be taken as the first criterion in discussing possible conclusions from the data given in Table III. Placing in order of size the various correlations with financial success that order is as follows:[12]

r(fm)=.848	r(fv)=.587
r(fb)=.801	r(fe)=.514
r(fi)=.732	r(fc)=.472
r(fn)=.700	r(fp)=.354
r(fk)=.677	r(fu)=.192

In their relationships with financial success, the qualities defined on pages 8 and 9 may evidently be grouped as follows:

Important	Less Important
Managerial Ability	Community Value[13]
Business Ability	General Education
Native Intelligence	Mechanical Ability
Technical Information	Physical Capacity
Field and Chore Skills	Unpaid Family Labor

From these data it is readily seen that such qualities or characteristics as managerial ability, business ability, native intelligence, skills, etc. rank high and are of evident importance in attaining financial competence. On the other hand, education, mechanical ability, physical capacity and unpaid family labor, although positive in value, are of less importance in productive farming. All of the characteristics listed, except community value (which was introduced to be used as a broader criterion)

12. Remember that "f" in each case refers to financial success and that r(fm)=.848 should be read as r(fm) and conceived of as the correlation between financial success and managerial ability. Similarly r(fu)=.192 is read r(fu) and is the value of the correlation between financial success and unpaid family labor.

13. Not to be thought of as a cause; rather a criterion.

might act as causal factors. If so, the order and relative values become interesting. One often hears the intimation that large families with women and children working at chores or in the fields are essential to financial success. The older native stock sometimes resents the coming of the newer, more prolific races into their communities and apparently forging ahead in spite of educational deficiencies and early financial limitations. Rating for unpaid family help in production was obtained merely to get a check on this point. The apparently low value of this relationship, r(fu)=.192, which may be interpreted as meaning that help of that kind, beyond the community average, is not generally necessary for success, permits us to disregard it as liable seriously to affect any conclusions that may be needed in the development of educational principles.

The relative order of the causal factors of success is important.

The correlation between financial success and physical capacity r(fp)=.354, is also so low as to eliminate itself in the matter of immediate consideration. It will, however, appear later as a minor factor of interest in its possible relationships to skills and mechanical ability.

Very different, however, are the relationships between financial success and managerial ability, business ability, technical information, etc. It is possible to conceive of men lacking in one or more of these qualities, apparently achieving success, but a closer study of conditions would probably reveal other factors operating, such as exceptional start, splendid soil, advantageous location and the like, which would tend to over-balance special personal handicaps. With such, more or less uncontrolled, factors favorable plus good managerial and business ability backed by a fund of practical, working facts, what might be the success attained!

Undoubtedly all of the characteristics listed, except community value, are direct causal factors of success in the order given. Size of family and physical capacity often backed up by non-American standards of living, however, do not take the place

of importance that is sometimes ascribed to them. If these correlations hold (and they will be subjected to further tests and analyses), farming takes its place in the social order not only as a skilled type of work but as a profession requiring direct managerial and business ability conditioned by special intelligence and training. The kind of training as an educational question will receive its merited attention later in the study.

Financial success is a proper criterion.

If it is objected that financial success is too low a standard or criterion, it will be noted that the inter-correlation r(fv)=.587 indicates that financial success and community value (see definition) have a decided tendency to go together. Further, technical training is undoubtedly training for production and financial success is a result and possible measure of production. Production, it may be added, is the usual measure of success in industry.

Considering community value, not so much as a criterion but as to its conditioning elements, the following correlations are of interest: r(vi)=.709; r(ve)=.654; r(vn)=.700.

These indicate that a man's value to his neighborhood is rather highly dependent upon or coincident with his native intelligence, his technical information, and his general education. Incidentally this same man seems to possess rather positive qualities as a business man and as a manager.

Continuing this method, one might discuss all of the basal and inter-relations, using each quality successively as a criterion, but this would be chiefly a matter of social interest and would not bear so directly upon the educational interpretations toward which the study is progressing. So far we have considered relationships between two qualities only. There remains a further step of special value in this type of investigation.

Partial Correlations.

Partial correlations offer one of the most interesting and valuable aids in interpreting the data at hand. Their possible use in analyzing out some of the more illusive factors and char-

acteristics of various types of industry warrant a somewhat detailed description of their application to this particular study.

Partial correlations provide a method of analyzing characteristics.

Partial correlations aid in eliminating disturbing factors—distortions that occur because of the difficulty in rating pure qualities and relationships. Moreover, this very value in separating out the undesired or disturbing elements makes it possible to analyze, to break them up into their elements. They provide for example, a method of analysis of such a complex as managerial ability. Their use may be illustrated by considering the pure relationship existing between financial success and field and chore skills. The definitions for field and chore skills and for mechanical ability seem to involve very different concepts but both characteristics have to do with handling external things—horses, tools, machines, and the like. It is very probable, therefore, that one's ratings for skills may be more or less mixed with one's rating for mechanical ability. If so, can the mechanical part of the skill be cast out of the relationship? Or, to consider it as a chemist might in manipulating the elements in an experiment, can it be held constant or controlled while the other elements are eliminated or used in varying relationships? Can the pure relationship between financial success and skill be determined while the mechanical element, that may be included inadvertently or by the very nature of the composition of desirable qualities due to valuable common elements, is held in abeyance or control?

Desirable qualities may have common elements.

Referring again to Table III, the following values may be found $r(fk)=.677$, $r(fc)=.472$, $r(kc)=.654$. These values may be called total values. In spite of the large number of judgments behind them there may be a constant tendency to confuse skills and mechanical ability. Moreover, as suggested above, there are undoubtedly actual relations due to common elements that cannot be separated. From a common sense view this is very evident. It is desirable to know, however, in deciding questions

of subject-matter, how much time should be devoted to developing farm skills, how much to training in carpentry, engine repair, and the like. What is the "pure" relation, we are anxious to discover, between success in farming and field and chore skills? The following formula[14] provides a method of getting rid of the purely mechanical part of the relation and r(fk) :c may be read as the correlation between financial success and field and chore skills with mechanical ability eliminated, equalized or controlled:

$$r(fk) :c = \frac{r(fk) - [f(fc) \times r(kc)]}{\sqrt{1 - r(fc)^2}\ \sqrt{1 - r(kc)^2}}$$

Substituting the above values in this equation, it takes the form:

$$r(fk) :c = \frac{.677 - (.472 \times .654)}{.8827 \times .7599}$$

Solving, r(fk) :c=.549. This indicates that there was some confusion or constant error—the total correlation r(fk)=.677 being in this case reduced in value to .548. On the other hand, what effect may a conception of skills have on a conception of mechanical ability? Solving similarly we find r(fc) :k=.052. This is rather startling. Does it mean that no mechanical ability is needed on the farm? Obviously not, but it may mean that a peculiar type of mechanical ability is needed that tends in rating to get badly mixed with skills. At least, it opens up the question of kind of mechanical ability and any one familiar with actual mechanical knowledge needed in operating a farm knows that carpenterial ability as shown by a cabinet maker or house carpenter is not particularly desirable. Moreover, one may immediately call to mind instances where mechanically-minded farmers who purchased threshing rigs often finally lost not only their machines, but their farms as well. Suffice this correlation to show that the question needs attention if we are to devise

14. See "An Introduction to the Theory of Statistics" by G. Undy Yule, Chas. Griffin & Co., Ltd., London; Chapter on Partial Correlations; also Mental and Social Measurements by E. L. Thorndike, pages 180-182; and Educational Guidance, T. L. Kelly, Ph. D., Teachers College Contributions to Education.

proper training work (manual training?) for farm boys. On the other hand, a real consideration of training for field and chore skills is shown to be needed, for over half of the people rated are probably farming with limited abilities in this respect.

Again one is lead to ask how much physical capacity enters into this question of skills? Can we eliminate that also?[15] Substituting the physical capacity correlation for mechanical ability, we use the following: r(fk)=.677, r(fp)=.354, r(kp)=.567, and solving the new equation r(fk) :p=.618. Again we are inclined to remember that it was not always the strongest boy that shouldered the sack of grain most easily or held out best in the long day's stacking work. One step further: Can we get both of these confusing factors out of skill, that is can we find the value of r(fk) :cp? Using the following formula:

$$r(fk):cp=\frac{r(fk):c-[r(fp):c\times r(kp):c]}{\sqrt{1-r(fp)^2:c}\quad\sqrt{1-r(kp)^2:c}}$$

we find that r((fk) :cp=.515. This tends again to back up the idea that there is a special farm type of skill that needs to be subjected to special study. Whether it is an innate ability or can be taught is also an important question.

Two or more disturbing factors may be successively eliminated. The formula for r(fi) :e n m, etc., will be the highest one used for this study.[16] In order to promote accuracy and facility it is desirable where a large number of relations are to be considered to adopt a standard form of procedure. Table IV illustrates this method. Column 1 is the total or partially cleared correlation; column 2 is the numerator of the formula; column 3 is the denominator, and column 4 is the new or cleared, resulting correlation.

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15. "Eliminate" or "cast out" should hereafter be considered in this larger aspect suggested above.

16. $$r(fi):enm=\frac{r(fi):en-[r(fm):en\times r(im):en]}{\sqrt{1-r(fm)^2:en}\quad\sqrt{1-r(im)^2:en}}$$

The use of Kelly's tables will greatly facilitate the computation work.[17] Several of these should be studied through to obtain the full force and value of the method. Procedure with it tends to do away with skepticism that naturally at first arises. Table V which follows is taken from the computations as indicated for Table IV, the last column or the cleared correlation only being selected.

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17. Bulletin of University of Texas No. 27, 1916.

Column 1 (Total Correlation)	Column 2 (Numerator)	Column 3 (Denominator)	Column 4 (Cleared Correlation)
(fi)	$r(fi)-[r(fe)\times r(ie)]$	$\sqrt{1-r(fe)^2}\ \sqrt{1-r(ie)^2}$	r(fi) :e
fi	.732—(.514×.732)= .356	.8617×.6834= .589	fi :e= .604
fe	.514—(.732×.732)=—.022	.6834×.6834= .467	fe :i=—.047
ie	.732		
fi	.732—(.700×.732)= .220	.7141×.6834= .488	fi :n= .451
fn	.700—(.732×.732)= .164	.6834×.6834= .467	fn :i= .351
in	.732		
fi	.514—(.700×.801)=—.047	.7141×.6000= .428	fe :n=—.110
fn	.700—(.514×.801)= .288	.8617×.6000= .517	fn :e= .557
en	.801		
fi :e	.604—(.557×.356)= .406	.8385×.9330= .773	fi :en= .525
fn :e	.557—(.604×.356)= .342	.8000×.9330= .746	fn :ei= .458
in :e	.356		
fe :i	—.047—(.351×.567)=—.246	.9367×.8216= .770	fe :in=—.319
fn :i	.351—(—.047×.567)= .378	.9987×.8216= .821	fn :ie= .460
en :i	.567		

18. Excerpt from a six-page table not considered necessary to include in this report.

TABLE V.

r(fi) =.732; r(fi) :e=.604; r(fi) :n=.451; r(fi) :m=.229
r(fi) :en=.525

r(fe) =.514; r(fe) :i=—.047; r(fe) :n=—.110; r(fe) :m=.000
r(fe) :b=.061; r(fe) :in=—.319; r(fe) :im=—.143

r(fn) =.700; r(fn) :i=.351; r(fn) :e=.557; r(fn) :m=.134
r(fn) :b=.278; r(fn) :ei=.458

r(fm)=.848; r(fm) :k=.714; r(fm) :p=.824; r(fm) :i=.649
r(fm) :e=.786; r(fm) :n=.675; r(fm) :c=.795
r(fm) :b=.572; r(fm) :ie=.656; r(fm) :in=.586
r(fm) :en=.679; r(fm) :ic=.636; r(fm) :kc=.713
r(fm) :ib=.508; r(fm) :eb=.580; r(fm) :nb=.522
r(fm) :ien=.554; r(fm) :kp=.728; r(fm) :cp=.785
r(fm) :ip=.635; r(fm) :ik=.564

r(fk) =.677; r(fk) :m=.221; r(fk) :c=.548; r(fk) :i=.430
r(fk) :p=.618; r(fk) :im=.197; r(fk) :cp=..515

r(fc) =.472; r(fc) :k=.052; r(fc) :i=.163; r(fc) :m=.079
r(fc) :p=.396

r(fb) =.801; r(fb) :m=.386; r(fb) :n=.592; r(fb) :i=.555
r(fb) :e=.717

r(fp) =.354; r(fp) :i=.198; r(fp) :k=.050; r(fp) :c=.226

r(ie) =.732; r(ie) :n=.356; r(ie) :p=.749; r(ie) :b=.527
r(ie) :v=.501; r(ie) :m=.522

r(in) =.732; r(in) :e=.356; r(in) :b=.403; r(in) :m=.334
r(in) :v=.469.

r(im) =.772; r(im) :e=.605; r(im) :n=.475; r(im) :k=.615
r(im) :c=.684; r(im) :b=.428; r(im) :e=.605
r(im) :en=.523; r(im) :p=.744

r(ik) =.606; r(ik) :c=.412; r(ik) :m=.145

TABLE V—(Continued)

r(ic) =.514; r(ic) :k=.196; r(ic) :m=.213

r(ib) =.752; r(ib) :e=.568; r(ib) :n=.463; r(ib) :m=.350

r(ip) =.307; r(ip) :e=.374

r(iv) =.709; r(iv) :e=.443; r(iv) ;n=.404

r(en) =.801; r(en) :b=.659; r(en) :v=.632; r(en) :m=.658
r(en) :i=.567

r(em)=.606; r(em) :i=.094; r(em) :n=—.031; r(em) :b=.255
r(em) :in=—.243

r(ek) =.414; r(ek) :c=.206

r(ec) =.414; r(ec) :k=.206.

r(eb) =.606; r(eb) :n=.049; r(eb) :m=.255; r(eb) :i=.124

r(ep)=.071; r(ep) :i=—.237

r(ev) =.654; r(ev) :i=.281; r(ev) :n=.217

r(nm)=.772; r(nm) :b=.454; r(nm) :e=.604; r(nm) :k=.626
r(nm) :i=.475; r(nm) :ie=.516

r(nv) =.700; r(nv) :e=.386; r(nv) :i=.376

r(mk)=.700; r(mk) :e=.621; r(mk) :c=.556; r(mk) :i=.458
r(mk) :p=.648; r(mk) :ic=.414; r(mk) :n=.480

r(mc)=.514; r(mc) :i=.213; r(mc) :p=.444; r(mc) :ik=—.022
r(mc) :kp=.101

r(mb)=.801; r(mb) :n=.541; r(mb) :v=.691; r(mb) :i=.521
r(mb) :e=.691

r(mp)=.354; r(mp) :k=—.073; r(mp) :c=.213; r(mp) :i=.193
r(mp) :kc=—.070

TABLE V—(Concluded)

r(mv)=.606; r(mv) :b=.255
r(kc) =.654; r(kc) :i=.502; r(kc) :e=.581; r(ke) :p=.588 r(kc) :m=.478; r(kc) :im=.465
r(kp) =.567; r(kp) :c=.471; r(kp) :m=.477
r(cp)=.354; r(cp) :k=—.027; r(op) :m=.213; r(cp) :km=—.019
r(bn) =.732; r(bn) :i=.403; r(bn) :e=.520; r(bn) :m=.298
r(bv) =.606; r(bv) :m=.255
r(nk) =.587; r(nk) :m=.103
r(cp)=.354; r(cp) :m=.213

Further Interpretations.

In order to be sure that the reader understands the source of the data for Table V it will be well to review the successive steps that have led up to it. Form A, Page 10 gives the ratings on two of the eleven characteristics that were defined on pages 8 & 9. This is for one group only of thirteen farmers as reported by a Kansas Senior. It is thus simplified to show the method of obtaining the summation G's by finding the delta differences between the positions of the men in their own group. The SG obtained gives the datum for use in the Spearman "Foot Rule" formula described on page 11. The one other unknown quantity needed being n^{19} or the number of men rated which in this study remains constant at thirteen. Form B given on page 15 is the blank on which the data for all of the groups were obtained. One hundred fifty-eight of these constitute the original data of this part of the study.

The successive steps leading up to Table V need to be clearly understood.

Table I, page 16, shows how the successive SG's, using financial success as a criterion, were tabulated. Similar tables were obtained using each of the characteristics or criteria resulting in over forty delta difference columns for each of the one hundred fifty-eight Form B's. Table II page 17 shows the tabulation of the successive SG's, the "Foot Rule" coefficients and the resulting Pearson coefficients for the relationships using financial success as a criterion.[20] Table III is the first composite table and contains the completed and finally accepted, total correlations. The characteristics listed across the top are to be considered in relation to or in correlation with the successive cri-

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19. Not to be confused with the "n" used to denote "information" as a characteristic.

20. The computation of each of these coefficients is unnecessary (see page 17) so that these tables will not appear as a matter of record.

teria at the left.[21] They should be read as follows: The correlation between financial success and native intelligence equals .732; between financial success and managerial ability equals .848; the correlation between education and intelligence equals .732; between education and skills equals .414; and so on for all of the relationships listed. Finally Table V gives the resulting partial coefficients as obtainable from the data of Table III.

Table III alone is of great interest and value and provides a source for important principles of curriculum-making. Table V with its possibilities of further extension, however, provides almost unlimited material for study in this field. The outstanding points only will be discussed.

The data of Table V may be studied from the standpoint of the apparent relative importance of the causal factors of success.

Let us approach the study of the data of Table V from the standpoint of the relative importance of the causal factors of success as described on pages 22 & 23. The highest factor—r(fm) equals .848, managerial ability—is evidently the major cause. From the table let us select all of the financial success-management correlations that have been computed:

r(fm) :p=.824
r(fm) :c=.795
r(fm) :e=.786
r(fm) :k=.714
r(fm) :n=.675
r(fm) :i=.649
r(fm) :b=.572

Using the data having only one characteristic eliminated or held constant it is readily seen that business ability enters more largely into the financial success, management relationships than does any other quality while physical capacity affects the relationship least of all. Again native intelligence stands next to business ability in importance while mechanical ability stands next to physical capacity in lack of importance. The factors of importance and more or less non-importance may be listed as follows:

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21. Let it be constantly remembered that each value given in this table is the mid-point value of one hundred fifty different correlations. It is the central tendency of all of the relationships that were obtained for the particular relationship in question.

Important	Less Important
(b) Business ability	(p) Physical capacity
(i) Native intelligence	(c) Mechanical ability
(n) Technical information	(e) Education
(k) Skills	

The conclusion from these data seems very clear: The good farm manager is possessed of good business ability and a high native intelligence supported with a fund of technical information and considerable skill. On the other hand physical capacity, mechanical ability and general education take positions of less importance in the analytic break-up thus attempted. Let us select certain further partial correlations of interest from Table V and arrange them in order of size of the coefficients:

r(fm) :cp=.785	r(fm) :in=.586
r(fm) :kp=.728	r(fm) :eb=.580
r(fm) :kc=.713	r(fm) :ik=.564
r(fm) :en=.679	r(fm) :ien=.554
r(fm) :ie=.656	r(fm) :nb=.522
r(fm) :ic=.636	r(fm) :ib=.508
r(fm) :ip=.635	

In this list the elimination from the financial success-management relation of mechanical ability and physical capacity reduces the value very little—r(fm) equals .848; r(fm) :c equals .795; r(fm) :p equals .824, and r(fm) :cp equals .785. It is clear, also, that mechanical ability is a stronger factor than physical capacity in affecting what deduction is obtained. Considering likewise the next highest partial correlation a similar result is found— r(fm)=.848; r(fm) :k equals.714; r(fm) :p=.824; r(fm) :kp=.728. Skill, like mechanical ability, enters more largely than physical capacity into the financial-management relation. Approaching these from the other end of the list we have r(fm) :ib=.508. Evidently intelligence and business ability enter the relationship in question very decidedly. The partials r(fm) :b=.572 and r(fm) :i=.649 indicate that business ability is the stronger of the two. This probably means that business

ability has many elements in common with managerial ability while native intelligence may be considered as an important causal factor of both.

Arranging a second list of relatively important factors or combinations of factors, we have the following:

Important.	Less Important
Intelligence—business	Mechanical—physical
Information—business	Skill—physical
Intelligence—skills	Skill—mechanical
Education—business	Education—information
Intelligence—information	Intelligence—education
Intelligence—physique	Intelligence—mechanical

The elimination of the intelligence-education-information combination, r(fm) :ien=.554, considered in the light of r(fm) :i =.649; r(fm) :n=.675; r(fm) :in=.586; r(fm) :ie=.656; r(fm) :en =.679; and r(fm) :e=.786 seems to indicate that education is not a requisite element in the relationship.

Again let us list all correlations having managerial ability used as a criterion:

r(mi) :p=.744	r(mi) :n=.475
r(mb) :v=691	r(mk) :i=.458
r(mb) :e=.691	r(mi) :b=.428
r(mi) :c=.684	r(mn) :b=.454
r(mk) :p=.648	r(mc) :p=.444
r(mn) :k=.626	r(mv) :b=.255
r(mk) :e=.621	r(me) :b=.255
r(mi) :e=.605	r(mp) :c=.213
r(mn) :e=.604	r(mc) :i=.213
r(mk) :c=.556	r(mp) :i=.193
r(mb) :n=.541	r(me) :i=.094
r(mk) :n=.480	r(me) :n=—.031
r(mn) :i=.475	r(mp) :k=—.073

The management-intelligence relation remains little affected when physical capacity, mechanical ability and general

education are successively eliminated. On the other hand it is much further reduced if information or business ability are taken out.

The management-business relation is less affected by the presence of the general education factor than by the information factor.

The management-skill relation is little affected by the presence of the physical or the education elements, slightly more by the mechanical element, and still more by the information and intelligence elements.

The management-information relation is less dependent upon skills and education than upon native intelligence and business ability.

The management-education relation is low at all times but the elimination of information and general intelligence factors more seriously affect it than the elimination of the business factor.

These partial correlations substantiate the first impressions regarding the importance of the managerial factor in farming. Moreover they enable us to analyze the farm management characteristic into some of its elements. Of most importance in good management are those qualities that condition good business power. A quality common to both business power and managerial ability and probably indicative of the necessity of considering original nature in farm-training is native intelligence. At all times this characteristic maintains its importance. This is noticeable even when business ability and information are eliminated and it is probable that such reductions as are indicated by the series r(mi)=.772; r(mi) :n=.475 and r(mi) :b=.428 are due to common elements rather than eliminations. Another important factor in good management is technical information. The lowest partials computed in this relation —r(mn) :i=.475 and r(mn) :b=.454—point to the same interpretations as suggested by the management-intelligence correlations. Field and chore skills and management also hold their tendency to keep together regardless of eliminations.

Managerial ability is vital to success in farming.

Managerial ability, therefore, is vital to success in farming and it is a quality that depends far more on native intelligence than on education or training. It and business ability probably have many common elements which in turn are conditioned by a special type of intelligence—a type of intelligence which should be subjected to further analyses.

Business ability is hard to dissociate from managerial ability, probably because of common element.

Next to managerial ability among the causal factors of success as given on pages 19-20 stands business ability. A partial discussion of this quality has appeared in connection with the discussion of management. It is impossible, at least with the present data, to dissociate it from management. Each has apparently the same effect on partial correlations as the other, indicating, as suggested above, that they have common elements that condition both qualities.[22] The third characteristic in the relative value of the coefficients is native intelligence—r(fi)=.732. This quality enters into other factors and must be considered largely as a cause of those other factors. The coefficients of interest in this connection may be listed as follows:

r(fi)=.732	r(mi)=.772	r(if)=.732
r(fi) :e=.604	r(mi) :p=.744	r(im)=.772
r(fi) :en=.525	r(mi) :c=.684	r(ib)=.752
r(fi) :n=.451	r(mi) :e=.605	r(ie)=.732
r(fi) :m=.229	r(mi) :en=.523	r(in)=.732
	r(mi) :n=.475	r(iv)=.709
	r(mi) :b=.428	r(ik)=.606
		r(ic)=.514
		r(ip)=.307

22. The determination of these common elements together with their divergent elements would make an interesting and valuable study in itself but for this, new ratings are necessary.

r(vi)=.709
r(vi) :e=.443
r(vi) :n=.404

r(fm)=.848	r(fk)=.677	r(fc)=.472
r(fm) :i=.649	r(fk) :i=.430	r(fc) :i=.163
f(fb)=.801	r(fn)=.700	r(fp)=.354
r(fb) :i=.555	r(fn) :i=.351	r(fp) :i=.198

r(fe)=.514
r(fe) :i= —.047

Native intelligence correlates in order of value with the other factors as follows: (See Table III)

1. Management
2. Business
3. Education
4. Information
5. Community value
6. Skills
7. Mechanical ability
8. Physical capacity.

In its relation to financial success native intelligence is affected by eliminating other qualities in order as follows:

1. Business
2. Information
3. Education
4. Mechanical ability
5. Physical capacity

In its relation to community value it is more affected by the elimination of information than by the elimination of education.

Again successively eliminating intelligence from the relation between financial success and the remaining qualities, it is seen to affect the financial-education relationship much more vitally than e. g. the financial-management relationship.

It would seem that we could draw the conclusion from the above that native intelligence as defined on page 8 is a very vital, causal factor conditioning managerial ability and business ability and technical information. The importance of this fact in working out methods of training and in vocational direction can scarcely be over-estimated.

Native intelligence seems to be a vital factor conditioning success.

The fourth causal factor is information. A study of this characteristic is evidently of direct importance in curriculum-making. The coefficients of interest in this connection follow:

r(ne)=.801
r(nm)=.772
r(ni)=.732
r(nb)=.732
r(nv)=.700
r(nf)=.700
r(nk)=.587

r(fn) :e=.557
r(fn) :ei=.458
r(fn) :i=.351
r(fn) :b=.278
r(fn) :em=.167
r(fn) :m=.134

r(nm) :k=.626
r(nm) :e=.604
r(nm) :ie=.516
r(nm) :i=.475
r(nm) :b=.454

r(fm)=.848
r(fm) :n=.675

r(fi)=.732
r(fi) :n=.451

r(fb)=.801
r(fb) :n=.592

r(fe)=.514
r(fe) :n=—.110

r(mf)=.848
r(mf) :n=.675

r(mk)=.700
r(mk) :n=.480

r(mb)=.801
r(mb) :n=.541

r(mi)=.772
r(mi) :n=.475

When information is used as a criterion the relationships with the other qualities remain very positive. When the various qualities are successively eliminated from the financial success-information relation that relation does not hold its own—managerial ability and business capacity causing the largest results in reducing the value of the correlations. Intelligence also enters strongly into the combination while education appears as of little direct value.

Again when various qualities are successively eliminated from the information-managerial relation there is a fairly uniform reduction extending in the case of the elimination of business of .318 points to .146 in the case of elimination of skills.[23]

Further, taking information successively out of the finance and the management relationships with other qualities, it is seen

23. [r(mn)=.772—r(mn) :b=.454]=.318
[r(mn)=.772—r(mn) :k=.626]=.146

to affect most directly finance-education and management-intelligence relationships having somewhat less effect on the finance-management relationship.

From the above data we may conclude that technical information as defined on page 8 has an important place in good farming.. Nevertheless there are latent suggestions that the community average of information is not greatly exceeded by the better farmers of the group. For example consider the correlation: r(fn) :m=.134 and r(fm) :n=.675, which forces us back again to the managerial cause as being fundamentally vital. The suggestion may be dropped at this time that the determination of the minimal, functioning knowledge may probably contribute to the future of secondary agricultural education much more than is now realized.

Technical information undoubtedly has an important function in good farming.

The fifth characteristic in the scale as indicated on page 22 is field and chore skills. The following lists of correlations will help to an understanding of the importance of this quality.

r(fk)=.677	r(mk)=.700	r(km)=.700
r(fk) :p=.618	r(mk) :p=.648	r(kf)=.677
r(fk) :c=.548	r(mk) :c=.556	r(kc)=.654
r(fk) :cp=.515	r(mk) :n=.480	r(kb)=.654
r(fk) :i=.430	r(mk) :i=.458	r(ki)=.606
r(fk) :m=.221	r(mk) :ic=.414	r(kn)=.587
r(fk) :im=.197		r(kp)=.567
		r(kv)=.514
		r(ke)=.414
r(fm)=.848	r(fp)=.354	r(fc)=.472
r(fm) :k=.714	r(fp) :k=—.05	r(fc) :k=.052

The elimination of management from the financial success-skill relationship leaves a very low correlation. Intelligence likewise affects the combination materially and the elimination of both management and intelligence still further reduces the value.

Mechanical ability seems to contribute to the relationship but physical capacity adds very little indeed.

Successively eliminating physical capacity, mechanical ability, information and intelligence from the management-skill relationship gradually decreases the correlation from r(mk)=.700 to r(mk) :i=.458. Again skills, it may be concluded, depend largely upon native intelligence.

Using skills as a criterion, management ranks highest and education lowest but the spread covers only .286 points.

Taking skills out of certain relationships affects the finance-mechanical correlation decidedly more than the finance-management correlation. This suggests again the discussion above on pages 25 & 26.

Field and Chore skills contribute directly and decidedly to success in farming. These skills are very largely dependent upon native intelligence—a fact which again suggests a deeper study into the type of intelligence for it may be found that a specialized intelligence is the background necessity in farm success. If so, the next step would be clear—a step involving determinations of the type of intelligence in question, followed by tests to ascertain its absence or presence in the individual.

Field and chore skills contribute directly toward success.

The relation of education, as incidentally developed in the preceding section, to either success or to the main requisite of success—managerial ability—was decidedly disconcerting. One might be tempted to conclude from the data studied that any definite amount of general schooling beyond what may be termed as the community average (one-room, rural school type) tends to be a disadvantage.

Without attempting at this point to make a case either for or against general education, let us study some of the correlations without reference to the finance or management criteria.

The following bear directly upon the educational question:

r(ei)=.732	r(ei) :n=.356
r(en)=.801	r(en) :i=.567
r(in)=.732	r(in) :e=.356

In these qualities the inter-relations are all comparatively high. The elimination of possible confusing factors seems to indicate that general education is of greater value when not directly functioning toward financial success. The partial correlations, r(en) :i=.567 and r(ei) :n=.356, suggest that those of highest native (farm type) intelligence may not be most directly attracted to education.[24]

Again let us study briefly the data bearing upon the relation of education, information and intelligence to business ability.

r(ie)=.732	r(nb)=.732	r(ib) :n=.463
r(in)=.732	r(ie) :b=.527	r(eb) :i=.124
r(en)=.801	r(in) :b=.403	r(nb) :i=.403
r(ib)=.752	r(en) :b=.659	r(nb) :e=.520
r(eb)=.606	r(ib) :e=.568	r(eb) :n=.049

Information and native intelligence again lead education in spite of the fact that intelligence bears the same relation both to information and to education. The business element seems also to affect the intelligence-education more than the intelligence-information relation. The intelligence-business relation is more seriously affected by eliminating information than by eliminating education—r(ib) :n=.463 r(ib) :e=.568. Again, eliminating the intelligence factor from the education-business relation nearly nullifies that correlation, while the same elimination reduces the information-business relation from .801 to .403. Information is important in buying and selling, etc., but it is information strongly backed or conditioned by native intelligence.

General education as usually understood in rural communities may not have any special attraction for the type of intelligence that seems to condition success.

Finally let us use the broader criterion of community value in the consideration of these mental values:

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24. The possibility of various types of intelligence should be kept in mind.

r(vi)=.709	r(ve) :i=.281
r(ve)=.654	r(vn) :e=.386
r(vn)=.700	r(ve) :n=.217
r(vi) :e=.443	r(vn) :i=.376

General education again fails to take precedence. Intelligence and information factors distinguish the man of largest place in the life of the community as well as the man foremost in financial success.

Educational Implications.

Objective analyses of industries may be used as bases of curricula.

This study is based primarily upon the assumption that objective analyses of an industry help to give the best basis for devising training plans for the workers in that industry. Moreover it attempts to get back of the mere facts and skills used in working processes and discover, if possible, the qualities, characteristics, etc., that function most directly and satisfactorily. It is believed that the discovery and statement of these will lay the proper foundation upon which to build curricula and training plans.

General farming and the agricultural specialties offer fertile fields for such objective studies. Conditions and fundamental principles of procedure in these occupations are comparatively stable. The basic skills have been a long time in developing. They are complex, not to be acquired in a day, and therefore do not tend to change except with far-reaching and gradual social changes. These skills, together with their allied knowledges, usually pass from father to son because of the farm-home-job nature of the occupation and this transmission takes years to effect. Because of this very conservative nature of the industry, the characteristics of the men in it have become more settled and more evident. When once discovered they will stay discovered and delimited, whereas in many other lines the study of today, although giving valuable results for present conditions, may only have permanent value in giving a method of analysis for succeeding phases in the development of the industry. The very diversity, complexity, and stability of the occupation requiring for

the general farmer abilities as a worker, as a business man, and as a manager challenge the educationalist. They challenge him to analyze the man, not only to lay bases for training plans and principles, but to make sure that the training when properly devised will not be wasted upon boys who may never be able to function successfully in such a complex field.

If conclusions from this study may be accepted, the general farmer, to be successful, should have qualities somewhat as follows:

The qualities, characteristics, etc., of the successful general farmer may be listed.

1. He should have slightly more, at least, than the average physical ability of the community. His strength and endurance need not be extraordinary, but he cannot be a weakling.

2. He has a certain advantage if endowed with some generalized mechanical ability, but if too highly developed and specialized, it probably works against, rather than with, certain other necessary qualities.

3. He must be possessed of some considerable amount of technical information—working facts available for quick and easy application.

4. He needs to have a fund of rather definite, specialized farm skills, like pitching hay and bundles to advantage, shouldering sacks of grain with ease and harnessing and handling two, four or six-horse teams quickly and effectively.

5. He is coming to be a business man able to meet neighbors and townsmen in transactions that do not leave him behind in the game. In connection with or supplementary to this buying and selling characteristic, he needs certain abilities in keeping records and accounts, giving him a basis for determining costs, profits, etc.

6. Fundamentally he must be a manager. Herein he approximates the industrial manager more than the industrial worker, differing chiefly, perhaps, in the fact that he deals relatively more with things and less with men.

7. Finally, so far as this study has data to determine, he must have a high degree of native intelligence—an intelligence probably more or less specialized, directly conditioning his skills, his ability to "pick up" technical information and his managerial power.[25]

The range covered illustrates the possibilities of the method of the study and it gives a real basis for certain conclusions of value in the field of secondary agricultural instruction.

The original make-up of the man needs consideration in secondary agricultural education.

Of the seven statements given above every one seems to be dependent upon characteristics or qualities that must be in the original make-up of the man. Physical endurance may sometimes develop out of seemingly poor beginnings, but on the average, at least, successful farmers must be able to do average days' farm work which most certainly require some considerable fund of vitality. Facts may be acquired, learned, but farm facts have to be working information, often available on a moment's notice and adaptable to many varying conditions of wind, weather, soil and society. Undoubtedly a high type of intelligence, more or less specialized and not to be gratuitously developed in all who come, is basic in acquiring and using these working facts or knowledges.

Field and chore skills are learned. Nevertheless some men never acquire them though they remain on farms all their lives. Others seem not to need even to learn them; they come so naturally. This is due to original, inherent differences in the indi-

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25. Doubtless other qualities of great value, or further breakup of the ones listed, could be determined, but the ones chosen are major and cover as wide a range as it was thought possible to include within the limitations of this study. The ratings together with the explanations covered an entire class period in every institution visited. It would have been inadvisable to try to get further material at this time and in this manner. Seminar groups and master degree students can well consider further studies looking to a wider range or a greater breakup of characteristics. The writer will be glad to make suggestions for such studies.

viduals. Since such differences are continuous and are found in all stages, some people with lesser native capacities may acquire, under adequate tuition, considerable facility in these lines. It is probable that, on the whole, the highly skilled father will be the best trainer of his boy, especially if that boy inherits to a greater or less degree his father's native capacities, but all boys are not thus fortunate. Skills can be induced often under very untoward conditions. Here the schools must enter and supplement or supplant the inadequacies of the home unit—an interesting and most valuable field for further investigation.[26]

Again good business principles can be taught, and buying and selling, accounting, can be improved in nearly all grades and types of intelligence. Undoubtedly this characteristic has more elements in common with business ability in other industries than the remaining characteristics listed. It is, moreover, probable that the average farmer needs a higher type of business acumen (covering cost finding in addition to buying, selling, etc.) than does the average worker in any other industry and possibly more than many so-called average business men.

Of all the characteristics, it is profitable to repeat, managerial ability stands first. It is less affected by confusing elements and therefore tends to be definite. It is directly conditioned by intelligence and therefore it may be classed as strongly inherent. It can be improved, trained, but only to advantage when the person in training has the requisite mental type and power to benefit from the peculiar training needed.

Is nature all important in the above characteristics? Is it the thing first to be considered? It is very important and will continue to be an increasingly important factor, more and more to be considered as farming develops in complexity and as competition in production grows. Nature will take a larger and larger part of the consideration unless big scale production be-

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26. This study can not go into the field of individual case study, working out from the experience and knowledge already possessed by the boy. It is, however, a field of vital value and interest.

comes the order accompanied by the decline of the quarter-section farm type.[27] Nature is of fundamental importance in the farming occupation. In this fact there may be some basis for the age-long prejudice of the farmer against "book-farming" or the advice of outsiders, be they college experts, agricultural teachers, board of trade members, bankers, or what not. If so, the recognition of the fact and the re-directing of our plans in accordance with right principles may do more to further proper agricultural education than is now supposed.[28] Nature will be of supreme importance in the future properly diversified, privately or co-operatively owned, intensive farm unit. Moreover, nothing will do more to promote such an ideal state than an agricultural education which adequately trains selected groups for types of work for which nature has best fitted them. But this is vocational guidance! Agricultural leaders will be the last to consent to any Prussian system of determination which assigns a child to a particular line of life work. And rightly so, for vocational guidance of this kind should be smothered in its beginnings.

When competition becomes intense in agriculture, "nature" will be of supreme importance.

Vocational direction and advice are very different things from vocational determination as it would be conceived by an industrial or political autocrat. They are best illustrated by recent studies in educational guidance. Such studies are trying to discover the aptitudes of the pupils chiefly for the pupils' sakes. Incidentally they will lay the best possible basis for the studies of the industries in the interests of both the pupils and the industries. Ultimately it will be the finding by and the fitting of the child for his best place in society. Vocational direction would

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27. Big scale production means highly trained directors controlling groups of laborers and making use of specialists. Many people, however, are not ready to concede that this type of rural organization is either advisable or generally probable.

28. Agricultural education is far from being generally accepted amongst farmers today. That it is not is only too evident to those who have daily to deal with the man on the job.

substitute for the present wasteful and chaotic trial and error method, scientific advice and suggestion based upon such evidence of the child's native capacity as might be obtained through carefully kept school records, objective ratings by successive teachers, scientifically devised tests, desires of parent and child, etc. Vocational direction, in a word, must be both scientific and human. To be scientific it must be objective, to be human it must focus on the child rather than on the industry. In being both scientific and human, we have faith also that it will be really and fundamentally social.

Vocational direction must be both scientific and human.

This matter of vocational direction is a field in itself—a field of tremendous importance as well as of interest. Its further study is urged especially in agricultural and rural education. The need is great in this field because many people (even born and living to maturity in the country) will never make good farmers and should have been directed or advised toward village or city industries or professions where both their competence and happiness might have been fully assured. Secondly, the need is great because the social and economic organization in the country lacks variety and opportunities for contact or experience.[29] The city boy has a wonderful chance for trial and error, wasteful as that method may be. The country boy on the contrary is significantly limited when it comes to trying out or even observing other than one or two kinds of farming and a few closely allied types of work. And, finally, the need is great agriculturally, because some means should be found to select out and provide possible trial opportunities for hundreds, perhaps thousands, of city youths who may have every requisite for success in farming, including mental and physical abilities, adequate capital, and the proper personal desire or interest.

But vocational direction, important as it may become, is only one part of the great problem. Given the boy with the proper desires and characteristics, how shall he be trained to

29. Rural Education (The Objectives and Needs of Rural Elementary Education). W. C. Brim. Macmillan Company.

make a greater success of what he would tend to succeed in regardless of formal school or vocational training?

The Training of the Boy.

Any possible deductions from the present study, of course, will be limited to the field of general farming as investigated.[30] Repeated emphasis has been given to the importance of the managerial aspect of farm success. In discussing this question from the training viewpoint the writer wishes to urge that a new approach may be advisable—a possible approach to the secondary agricultural education question in general farming through the avenue of management. Management involves control—control, in this case, of such factors as crops and cropping, hand, team and power labor, invested and operating capital—control that intensifies here, extends elsewhere, applies cost methods when needed—control in changing plans to meet emergencies in weather, markets, or what not. Management requires objectivity—an outside viewpoint. The engineer is outside the machine. He comes to it and goes from it. He gets away from it at night, for the week end, or possibly for the season.[31] So far agricultural teaching has tended to lose sight of the inclusive nature of managerial success. Courses in soils, in crops, in breeds and breeding, have emphasized the break-up and

The best training approach may be through management.

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30. It is hoped that, since the field is opened up, future studies will not only consider specialties like poultry raising, fruit growing, etc., but will subject general farming to much more detailed analyses. The conclusions drawn seem to be supported by the evidence at hand for general farming (dairying and allied crops) in New York State as well as general farming (corn, wheat, stock, etc.) in Ohio or Kansas.

31. It is suggested that the very nature of the present organization of the farm tends to prevent this viewpoint. The farmer is born, brought up, eats, sleeps, has his whole life-long being within his job—sometimes under it, if the mortgage is heavy. Under such circumstances, only the exceptional man can get the inclusive, objective viewpoint of his farm as a machine and a job.

promoted specialized interests long before the inclusive view is attempted.[32]

Perhaps a reference and an illustration will help to enforce the viewpoint of this discussion. "Professor Mann would combine theory with practice much more intimately than occurs in the law schools of the present day by requiring the student to learn to operate the 'case' under study. The student must not merely observe and analyze the operation of the dynamo: he must actually run it and repair it when out of order."[33] Add to this reference the following illustration: A boy happens to come upon a man (perhaps a teacher) who is observing a small gasoline engine, evidently his own and with which he is very familiar. The boy's interest causes the man to start the engine and operate it for a few minutes. Later he and the boy (or the boy and he) start it, operate it, take it apart, discover its secrets and principles of construction and working, assemble it, start it again, repair it when necessary, etc., until the boy knows that little engine from a to z. In this "case" there is, first, the whole, the inclusive, the objective view of a machine. Secondly, there is the investigation into its make-up and into the "how" and "why" of its working. Thirdly, there is the re-assembling and the re-operating of the whole machine. There is understanding and control of an outside, objective whole. The parts are known but entirely in their relation to the whole machine and its functioning. The farm home and the farm machine have been confused. Man-

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32. College courses in farm management naturally and rightly are given after the technical courses are well under way or completed. The writer does not wish to get into a controversy on the subject of the collegiate curriculum, much as it needs attention. He does, however, object strenuously to the policy of secondary schools following the same plan of courses in training boys for farming. He is wondering if courses in "managing a farm" may not be devised, using as a basis this principle of objectivity.

33. Preface to "A Study of Engineering Education" by Charles R. Mann, Bulletin No. 11, Carneigie Foundation for the Advancement of Teaching."

agerial control can best be asserted when the operator gets outside or on top of his working plant instead of being hopelessly mixed up within or under the works.

If the writer is not mistaken, this objective study and control is the essence of good management and, if so, may it not be applied to the farm working unit and to the teaching of the operation of that unit? This viewpoint, however, is so largely based upon opinion and this study is attempting to break away from subjective prejudice, that the idea will not be urged but will be left to propagate itself if it have the necessary worth and vitality.

Objective control seems to be the essence of good management.

An essential tool of the farm manager is the fund of technical information that he has at hand for ready use. And it is the teaching of this that tends to get us back onto tried and sure ground. We feel more certain when it comes to getting ideas or facts across to the boy. Because of this we are prone to make the class room impartation of the facts the whole point of our training. The writer feels, however, that he must urge the necessity of training the boy managerially. The facts or information are to be considered only as factors of the larger problem—tools of the job—of value only as they function in the control of the outside, objective machine that is working to produce crops, stock, etc.[34]

Technical information is an important tool of good management.

If we are to consider the agricultural information as a tool—a supplement to the larger managerial power—the problem of finding the facts that really function and organizing them into

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34. Two kinds of facts or information should be distinguished—those common, daily used facts possessed by the better farmers and those special informations more often possessed by the expert to be given out as advice in difficult or dangerous situations. It may be more important in training the future farmer to develop in him a respect for the expert and an ability to find the expert rather than the quack, than to train him in the expertness that he will use too seldom to keep him in practice.

proper teaching units becomes the important thing. As was suggested in the first part of this report, the study of this phase was temporarily abandoned for the determination of the essential characteristics of the successful farmer. The proof of the importance of technical information in farming justifies a return to its consideration and to further pursuit of its study. It is here that the principle of minimal essentials becomes so helpful. The present plan includes the following procedure:

The usually taught facts and principles in a limited field are listed in the form of simple, concrete statements. Duplications are eliminated and the list reduced to as low proportions as possible, yet suggesting all of the material. This material is finally printed in such form as to permit the rating of each item. It is evident that each item may be useful or not useful in promoting production. Five grades of value may be assigned and a figure 1, 2, 3, 4 or 5 placed after each item to indicate the value as considered by the person making the rating. Number 1 would indicate that the item was essential and could not be dispensed with without serious loss in production. Number 5 would indicate that the item was never used and could or should be dispensed with. Other numbers, 2, 3, or 4, would indicate intermediate or relative values. Such report blanks will be sent to large numbers of men in actual farming who are familiar with the technical terms necessarily employed. The idea is to get an objective concensus of actual use of the facts in their relation to production. The central tendencies for each item will reveal their values and at the same time show in skeleton outline the general principles around which they will best be organized.[35]

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35. As a beginning in this method of determination of minimal essentials, mailing lists from several states are being obtained and the analysis of market milk dairying has been begun.

Such bodies of minimal essential, working, organized facts will be of untold service to the teacher-trainer, the teacher, the the supervisor and the student himself. As it is, the field is so large and the interest element on the part of the teacher, together with the tendency to follow beaten paths and lines of least resistance, is so great that often the materials used and methods chosen fail to function toward clearly defined objective results. Moreover, many minds do not have the faculty for going to the heart of a subject and discarding the more or less useless, or for organizing elements according to their relative values. As a time saver what would serve more directly and effectively?[36] As a standard of accomplishment, what would give a better measure? As a working tool in the hands of the man responsible for production on the farm, what would be more effective?

Minimal essential determinatitons are of great value in secondary agricultural education.

For some time manual training of the indiscriminate type has been subjected to severe criticism. The results of this study certainly add force to that criticism. The application of the principles of objective determination and minimal essentials seem to offer a way of finding out just what should be taught in the mechanical as opposed to the farm skills' phase. Unit courses in gas engines, as indicated in the illustration given, in overhauling farm machinery, and in the selection and care of the few mechanics' tools that should be a part of the equipment of every farmer are evidently valuable and interesting types of work that may be carried on without special laboratory facilities.

Minimal essential studies are also necessary in the mechanical aspects of the work.

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36. When it is remembered that many boys have only one or two winters of a few months each to devote full time to school attendance and further when it is remembered that even the four-year high school can legitimately devote one-half or less of the time to vocational training, the time element becomes of special importance.

The field and chore skills section of the boy's training as a future farmer is so important as to require special emphasis. The tendency is to assume that he has and is obtaining such training on the home farm and since no one knows how to go about planning and organizing courses to teach these skills the work is ignored. Technical information and field and chore skills are the two most effective tools of the good farm manager. So far as the writer knows no one has ever attempted to study or list farm skills. An inventory of these would be a good introduction to such a study. Carefully prepared descriptions of the best practice could follow.[37] Since the boy is constantly engaged in skill use and practice at home, it may be that the teacher or the school can function most directly from the description and criticism standpoints. The farm boy probably comes to his agricultural training with more field and chore skills well developed than with any other phase of his training start. Special abilities should be recognized; deficiencies should be checked up.

Field and chore skills have never been listed and studied.

A further field for graduate student investigational work lies in the business aspects of the boy's training. The farm management people have done most excellent service in devising record, accounting and cost finding schemes. Possible unit courses should be worked out from such data. In connection with this, principles of buying and selling should be drawn on as developed in the merchandizing courses and purchasing agent work.

Success in modern agricultural production is demanding more and more business ability.

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37. Here again is an excellent opportunity for graduate study and the possibilities of a scientific measuring scale of skill ability are very great.

It is hoped that enough has been said to enforce the viewpoint of this study, namely; the necessity for objective analyses of the men and the job as bases for curriculum-making and teacher-training. The field is really four-fold and covers not only the necessity for men-and job-analyses but also field-and boy-analyses. The field-analyses involve the standardization of methods for local study so that the teaching will function directly toward the type of agriculture of the community. The boy-analyses are the natural complements of the man-analyses, laying the basis for real vocational direction and advisement as well as proper methods of training. Objective studies provide a sensible and scientific method of getting away from the tryanny of opinion and tradition and this study will be of value, not because of the number of principles it may develop but because of the field it opens up and the future studies to which it may lead.

The work outlined demands analyses of the man, the job, the field and the boy.

Considerations.

1. The basis for curriculum-making and procedure in it should grow out of objective studies of the job and of the people functioning in that job.

2. There seems to be a more or less specialized type of farm intelligence which needs delimitation and study as a basis for vocational direction and vocational training plans.

3. Training for a job, especially such a complex one as general farming needs an objectification of that job which presupposes both an inclusive and an outside view.

4. Training in the details of a job should consider those details or factors constantly from the standpoint of their interrelations and their sub-relations to the job itself.

5. Vocational education is not necessarily bound up hand and foot in general education—indeed this study would seem to indicate a clear severance of the two. General education does not appear to function directly toward vocational efficiency. This may mean that the ideals of education as actually carried out tend to attract a type of intelligence that is not best suited to agricultural productivity.

6. In view of the fact that society demands more of its members than vocational competence to insure its progressive development, general education in some form or other is necessary. A general education, therefore, that is not unattractive to the specialized intelligence needed in agricultural work would seem to be the requirement. Such an education, in the opinion of the writer, should do at least two things:

(a) Give a sufficient basis in English, Mathematics, General Science and Social Science to prepare the student to understand the later vocational training and work.

(b) Prepare for adequate citizenship and social functioning.

7. In order to obtain time for this needed general education, two things are necessary:

(a) Longer period in school.

(b) Higher efficiency in the vocational training field.

Note: Such training or education must not be either ultra-cultral or ultra-practical. The needs of both the abstract or literary type of intelligence and the work-a-day, managerial, concrete type must be recognized.

8. General education and vocational education for the present, at least, should progress more or less separately, each studying its respective field objectively, determining its functioning essentials, but co-operating at every turn. Each must realize its dependence upon the other; neither can go far alone.

9. The following topics are suggested for seminar and graduate study:

(a) Fundamental characteristics of both the man and the job in various lines of agricultural production.

(b) Minimal essentials in all of the fields or specialties.

(c) Tests to determine innate characteristics for rural boys.

(d) Pre-requisite, foundational, explorative work for junior high school courses.

(e) Study of the business essentials in general farming.

(f) Managerial rating sheets or score cards.

(g) Scales for measuring skills, managerial ability, etc.

(h) Use of case, unit, project, problem and other methods in various aspects of the instruction work.

(i) Standard record cards for grades and junior high schools for vocational direction data.

The Reliability of the Data.

So far it has been assumed that the ratings as given on the various Form B's (the original data of the study) were always correct. As a matter of fact, however, it is probable that there are many misplacements of men in the groups. If it had been possible to obtain four, five or six separate student ratings on each group it is probable that there would have been differences more or less marked. Moreover, the ability of students to act as judges may be questioned. It may be very legitimately contended that the only way to tell how thirteen farmers should be arranged in order of financial success from best to poorest would be on the basis of information obtainable by the usual farm management survey methods. Even this could be criticised and is being criticised, especially if the criterion used be the labor income criterion, which has been the basis for most surveys so far undertaken.

The method of ranking individuals for certain qualities or characteristics may be open to question as to its reliability.

But, granting the validity of the labor income criterion, what would be the possibility of its use in such a study as this? At first plans were made to tie up the determination of the characteristics and qualities desired to the groups of farmers in various states who had been subjected to labor income surveys by the usual farm management methods. With random selections from such lists it was hoped to have several different judges (county agent, banker, high school agriculturist and others) rank the same group and from these data obtain the desired correlations. But this was found to be an almost impossible

task. Moreover, the number of groups to be rated would be so limited that local variations would be a serious factor, making it inadvisable to draw generalized conclusions from the data obtainable. Finally, after repeated try-outs which tended to show certain constant results in spite of possible imperfections the method used in the study was decided upon and pursued in as guarded a way as possible.

In general, ratings by these men may be defended from the following standpoints: To begin with each man stated that the farmers in his group were well known to him. In fact, in the great majority of the cases they were men of his home community onto whose farms and into whose homes he had repeatedly gone. Only a person who has grown up in such an environment can realize how fully these qualities and characteristics are known and discussed by all of the members of the community. It is this very intimate common knowledge of the financial and other affairs of the neighborhood that is used as a basis for loans in some of the co-operative enterprises that have grown up. "Change of work", for example, has brought families into close contact with each other's skills, physical capacities, personalities, etc. Moreover, the students making the rankings are as a class a selected group of the finest young men, endowed with keen observation and judging powers. Of this, the writer was often reminded in the brief discussions that followed the exercise. Very few of the men seriously questioned their ability to place the upper and lower two-thirds of the groups. Sometimes they were less sure about the order of those who were finally numbered 6, 7 or 8. But the misplacement of these men one, two or three places would tend to effect the final value of the coefficient very little indeed as may be learned by working out various trial orders. A somewhat significant reaction to the method came from the instructors or professors. An attempt was made to get ratings by mail from a number of schools. To this, in general, a poor response was obtained. A few did not answer at all, others did not have the right type of students or the special opportunity and a few

Students from farm communities are peculiarly fitted to provide the desired ratings.

answered frankly stating their skepticism of the proposed method. On the other hand no institution was found in which the ratings were taken by the writer in person where the professors and instructors in charge were not keenly interested and evidently sympathetic with the method and the possible value of the results. Many of these men voluntarily took part in the exercise, submitting their reports with those of the cless.

Many instructors and professors on understanding the problems and the method became keenly interested.

It is probable that most of the errors are of a kind that would tend to balance each other and, therefore, have little effect on the final value of the coefficients. There are, however, undoubtedly two kinds of constant errors that should be noted. One is what may be known as the "halo."[38] This in a few words is a tendency on the part of judges to ascribe higher values than should be in all qualities to certain men because of their general standing and success. For example a judge placing a man high in the scale for intelligence, would tend to place him high also for information or skill or managerial ability regardless of the facts in the case. Opposed to this is another error for which correction often should be made. This is known as "attenuation"[39] and in general is an error that tends to reduce the value of the coefficient. Since the error due to the "halo" and the error due to "attenuation" operate in opposite directions and since with the present data corrections for neither can be made to advantage, each will be assumed to equal the other and therefore to have little or no effect upon the finally accepted coefficient values.

Most of the errors were probably of a kind to offset each other thereby causing little effect on the finally accepted values.

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38. See article by Dr. E. L. Thorndike—"A Constant Error in Psychological Ratings," pages 25-29. The Journal of Applied Psychology Vol. 4, No. 1.

39. Mental and Social Measurements by E. L. Thorndike, pages 177-180.

TABLE VI.

Total Correlations—General Farming.

		(f) Financial Success	(i) Native Intelligence	(e) General Education	(n) Agricultural Information	(m) Managerial Ability	(k) Field and Chore Skills	(c) Mechanical Ability	(b) Business Ability	(p) Physical Capacity	(u) Free Labor	(v) Community Value
(f)	Financial [40]		.689	.472	.711	.844	.711	.528		.307	.176	.618
	Success [41]		.732	.514	.700	.848	.677	.472	.801	.354	.192	.587
(v)	Community		.741	.682	.746	.647	.567	.471		.209		
	Value	.587	.709	.654	.700	.606	.514	.414	.606	.217		
(i)	Native			.700	.711	.711	.606	.543		.209		.741
	Intelligence	.732		.732	.732	.772	.606	.514	.752	.307		.709
(e)	General	.472	.700		.711	.528	.295	.477		.018	.018	.682
	Education	.514	.732		.801	.606	.414	.414	.606	.071		.654
(m)	Managerial			.528	.711		.782	.612		.400	.214	.647
	Ability	.848	.772	.606	.772		.700	.514	.801	.354		.606
(n)	Agricultural	.711	.711	.711		.711				.112		.746
	Information	.700	.732	.801		.772	.587		.732			.700
(k)	Field and	.711	.606	.275		.782		.618		.521		.567
	Chore Skills	.677	.606	.414	.587	.700		.654	.654	.567		.514
(c)	Mechanical	.528	.543	.477		.612	.618			.401		.471
	Ability	.472	.514	.414		.514	.654			.354		.414
(b)	Business											
	Ability	.801	.752	.606	.732	.801	.654					.606
(p)	Physical	.307	.209	.018	.112	.400	.521	.401				.208
	Capacity	.354	.307	.071		.354	.567	.354			.000	.217

40. Correlations appearing above are from data obtained in New York, New Jersey, Connecticut and Maryland.
41. Correlations appearing below are from data obtained in Ohio, Michigan, Nebraska, Iowa, Kansas and Oklahoma.

Probably the most convincing evidence that the data may be taken as fundamentally reliable may be obtained from a study of Table VI. This is a combination table including the data of Table III as given on page 21 and a second set of data similarly but independently obtained from the four eastern states of New York, New Jersey, Connecticut and Maryland.[42] A casual inspection of these figures at once shows their likeness. In no case is there a wide divergence—the widest occurring in the inter-relationship between Field and Chore Skills and General Education, a difference of only .119. In the main, the procedure in obtaining these two sets of data were sufficiently alike to make it possible to compute their proable error, which roves to be only .035.[43]

Two separately obtained and computed sets of data show a remarkable consistency.

42. These data were obtained and worked up before the Middle Western States' data were gathered. The latter were much more carefully guarded and procedure more fully standardized so it is felt that their probably increased accuracy justified their use in the study in preference to that first obtained. Business ability was not included in the earlier study and a few inter-correlations were incomplete.

Scale	Frequencies	Totals
+.100 to +.090	1	1
+.090 to +.080	1	2
+.080 to +.070	0	2
+.070 to +.060	1	3
+.060 to +.050	3	6
+.050 to +.040	4	10
+.040 to +.030	3	13
+.030 to +.020	2	15
+.020 to +.010	1	16
+.010 to .000	1	17
.000 to —.010	2	19
—.010 to —.020	1	20
—.020 to —.030	1	21
—.030 to —.040	2	23
—.040 to —.050	4	27
—.050 to —.060	1	28
—.060 to —.070	2	30
—.070 to —.080	1	31
—.080 to —.090	0	31
—.090 to —.100	2	33
—.100 to —.110	0	33
—.110 to —.120	1	34

43. Having these two sets of data obtained and computed in similar ways but entirely independently the probable error may be found as follows: Beginning with the r(fi) relation which has the two values .689 and .732 the difference, substracting algebraically, between the two is found to be —.043. Continuing this the difference for all the relations (without repetitions) may be arranged in a scale as given at the left. From this it is readily seen that the first and third quartiles fall at +.045 and at —.045. Adding these and dividing by two gives the .045 which may be taken as the PE of the differences. Using the formula: PE dif$=\sqrt{PEa^2+PEb^2}$ and substituting we have $.045=\sqrt{2PE^2}$ because the PE of the eastern data (a) may be assumed equal to the PE of the western data (b). Solving this equation PE equals .0345.

This means that the true value will stand fifty chances out of a hundred of being not more than .035 greater or less than the obtained value. It means that a coefficient of .600 would not be greater than .635 or less than .565 in fifty out of one hundred cases. However, the more nearly a coefficient approximates zero, the larger the probable error will be but even so, the probable error of a zero coefficient would equal only .054. So far as the present study is concerned, these values are practically negligible.

The writer, of course, must be considered as a prejudiced witness. Nevertheless, he would like to state in further defense of the method that a conception of its reliability has grown upon him, largely due to the fact that scarcely ever did even a second or third order partial coefficient prove inconsistent with the general results of the study. For a time it seemed impossible to accept some of the relationships indicated by the partial correlations having to do with general education, but the further those results were considered in connection with actual farm communities, the more their possible truth came to be recognized. It is suggested that the age-old indifference of farming communities to much general education for themselves, beyond the community level, may be a little positive evidence in this particular.

The resulting coefficients show a remarkable consistency.

Again, a third set of data was separately obtained and so far as it has been worked up it fully substantiates the data used and in several cases actually proves identical. This leads to the belief that the central tendencies accepted for the 2,000 middle western farmers and also found practically the same for the eastern groups and still further backed up by the third or final set, so far as computed, would be the most probable central tendencies were two million men rated instead of the four or five thousand that were actually considered.

The rating of 2,000,000 men would increase the reliability but would probably not greatly change the actually accepted values.

VITA

EDGAR CREIGHTON HIGBIE was born in Green Lake County, Wisconsin, July 31, 1875.

He received his early education in the public schools of Minnesota and in Ripon College Academy, Ripon, Wisconsin. He was a student at Carleton College, Northfield, Minnesota, in 1901 and 1902 and received degrees of Bachelor of Arts in Education and Master of Arts, respectively in 1907 and 1909 from the University of Minnesota.

He taught rural and graded schools in Wisconsin and Minnesota for four years and was city superintendent of high school systems for five years, after which he was superintendent of the West Central School and Station of the University of Minnesota for seven years. From this last position he resigned in 1917 to pursue further study for the Doctors Degree at the University of Chicago ond Columbia University. He is a member of Minnesota Chapter of Phi Delta Kappa.