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A THESIS

HOW MAY HIGH SCHOOL PUPILS BE GUIDED IN THEIR
SELECTION OF SCIENCE WORK OTHER THAN BY THE
MERE GENERAL OPINION OF THE TEACHER ?

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BY
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Compulsory education has brought with it a problem with which educators are confronted and which must be seriously studied if we are to give to the pupils in our high schools the best training possible.Formerly there was a set course of study that all of the pupils in the high school had to complete before their graduation. Those pupils who were able to master these given subjects were labelled fit for entrance to college by means of their diploma of graduation.Those who could not master the given curriculum were dropped from the roll.At the present time we are striving to train every pupil that comes through our doors to make the best possible use of his capabilities in this big democracy of ours regardless of whether or not he is going to be able to go to college and prepare for one of the professions.

Most of the compulsory education laws of the states require children from eight to fourteen years of age to remain in school and as a result of these requirements we find that our high school enrollment has increased tremendously in recent years.What kind of training to give this greatly increased number of pupils has puzzled curriculum makers.The old standard curriculum has given away and today we find pupils graduating from high school,some having finished the Academic,some the Technical,some the Commercial,and still others the Elective Curriculum.They have not all had the same training,yet they are all termed graduates of the high school.These different routes by which pupils may finish their public school education are all attempts at providing a means by which pupils may best prepare themselves for their futures.

The problem that this present paper deals with is only one of many that educators are being called upon to solve.How can we determine whether or not a pupil can successfully complete any specific course of study that he selects?In order to study the question,I have selected the sciences in high school as a field in which to investigate.I want to determine as nearly as possible how we can guide pupils in their selection of science work so that they will be able to master a given science once they have begun a study of it. So often we find pupils struggling to learn a given science when in reality they are either unprepared to take that subject or else incapable of learning it.The teacher may make a scientific investigation to ascertain the cause of the failing or,as I fear is too often the case,he simply lets the pupil go on to the end of the term and then brands him as a failure.The whole idea of my undertaking this present investigation is to find out how we can advise a pupil before he begins a course not after he has failed.If we can determine in advance whether or not a pupil can successfully complete,we will not only save the tax-payer,the parent,and the teacher much in money and worry,but we will also save the child his time and energy as well as his self-respect.The habit of failing is a bad one and probably functions throughout the child's whole later life.If a child only has the mental capacity to become an efficient street-cleaner,it is ridiculous to try to train him to become a doctor or lawyer.So it is in

high school--a pupil who would perhaps make a good printer often
desires to become an electrician and takes Physics rather than
Printing.It is our duty as teachers to influence this boy to take
Printing rather than ~~Printing.~~ We cannot hope for a perfect means
of determining who is who,but we can certainly inform ourselves
so well that we can advise pupils with a fair degree of accuracy.
All of the following data is given with the hope that it will
serve as a means by which teachers can advise prospective science
pupils with a greater degree of accuracy than has heretofore been
the case.

The general scheme followed was to give intelligence
tests to those pupils taking the science in this high school.This
was done by having all the pupils taking General Science,Biology,
Chemistry,and Physics assemble in the auditorium and take the test.
Two weeks later these same pupils were assembled and given a second
intelligence test that correlated highly with the first test given.
The final score given a pupil was determined by taking the average
of his two tests.although,as claimed by some authors,the individual
scores of those in a large group will be lower than if given indi-
vidually,yet for comparative purposes it is legitimate to give the
tests to large groups.These intelligence tests were given the first
three weeks in October 1924 and were followed by achievement tests
given in the classroom the last week in January 1925.The results
should show what relation exists between a pupil's capacity and his
achievement in the science he is taking.I shall present below the
tabulated results accompanied by comments,and later see what con-
clusions may be reached.

The tests were given to 483 pupils,but complete data
was secured for only 428.Therefore the tables will include only the
scores,etc.of those 428 pupils who took both the Terman Tests and
the Achievement Tests in the four sciences being taught.Mention will
be made in regard to those who dropped out and such conclusions
drawn as the limited amount of data will furnish.

Table I contains the tabulated results of the average
scores by subjects on both Form A and Form B of the Terman Group
Test of Mental Ability.The nomenclature designates the length of
time a pupil has been studying that particular science-for instance-
General Science 1,Column A,means that it includes only those pupils
who have been studying General Science for a period of four and
one-half months.Further,Biology 2,Column D,means those pupils who have
been studying Biology for a period of nine months.Table II gives
the Intelligence Quotient distribution.Table III gives the Mental
Ages of the pupils.Table IV is a distribution of the chronological
ages of the 428 pupils.Table V is a distribution of the actual term
grades or marks given the 428 pupils by their five teachers.Tables
VI to IX inclusive are the tabulated results of the Achievement or
Subject Tests given.

The median Score for General Science 1 was 84.7,for
General Science 2 it was 91.4,for Biology 1 it was 111.0,for Biol-
ogy 2 it was 114.0,for Chemistry 1 it was 131.9,for Chemistry 2 it
was 143.0,for Physics 1 it was 145.0.It may be seen at once that
the pupils making the highest median scores are those taking Chem-
istry 2 and Physics 1.Reference to Table IV,however,will show that
these pupils are also older than any other groups in the table.
Reference to Table II shows that these two groups also have higher
median IQ's than any of the other groups.the reason probably is

due to the greater selectivity which exists among the third and fourth year high school pupils,those of lower mental ability either having dropped out of school or else having gone into other branches of the school's work.Under each table is a key by the application of which they may be readily interpreted.For the present purpose Table II is the one that will be referred to constantly, since it is an index to the mental capacity or ability of the pupils in the several subjects.Table II,in conjunction with the Achievement Tables,Table III,Table V,and the original statistical sheets from which these tables were compiled will serve as the basis of the present investigation.

In column G of Table II we find that 32 pupils are taking Physics 1.The median I.Q.is 102.5,while the interquartile range is from 93.3 to 109.One fourth of the number of pupils taking this subject have I.Q's.below 93.3,while one-fourth have I.Q's above 109.How much better can those above 109 learn Physics than those below 93.3?Does the IQ of a pupil serve as a good basis for a prediction of how well that pupil can learnPhysics? What IQ is necessary in order for a pupil to successfully learn Physics?These and other questions will be considered in the following analysis.

Table II shows that there were 7 pupils with an IQ of 110 or more.Table IX shows that there were 8 pupils who made a score above 80.Reference to the statistical sheets shows that 4 of the 8 pupils making more than 80 had IQs above 110,while the other four had IQs of 107,99,92,and 91.Of the three remaining with IQs above 110,one made a score of 75.3,another made 47.4,and the last made 43.3.The writer taught this Physics class and knows it to be a fact that two of these last three are girls who did not do their best, but seemed to be satisfied just to pass,and also that the remaining boy who is now taking Physics 2,last month did such good work that his monthly grade was B,which by the marking system means superior work.Of the 8 A's and B's given by the teacher on the term's work 5 were given to members of this group whose IQ's exceeded 110. Referring to Table III and the original sheets I find that the average mental age of the 7 pupils whose IQ's exceeded 110 was 18 years 2 months.These facts show plainly that a pupil with a mental age of 18 years 2 months and an IQ of as much as 110 can successfully take Physics in the high school.

Referring to Column G Table II,we see that there were 4 pupils whose intelligence quotients were below 90.Table IX shows that there were 4 pupils who made a score of less than 24.When I look at the statistical sheets,I find that 3 of the 4 making a score less than 24 are 3 of those having an IQ below 90.Of the four E's given as marks on the term's work,I find that two are from this group of four pupils.The other two with low IQ were graded D by the teacher.The average mental age of these four pupils was 13 years 8 months.The foregoing data seems very good evidence that pupils whose mental ages are less than 13 years 8 months and whose IQ's are less than 90 cannot do satisfactory work in Physics.

In considering the group whose IQ's were between 90 and 110,I find that there were 8 pupils whose IQ's were less than 100,and that of these 8 pupils only 3 made a score above 50 on the Achievement Test,while 2 were repeaters having had the course the previous term and failed.The average mental age of the 8 pupils was 14 years 11 months.The term marks given by the teacher were 2C's,4D's,and 2E's,thus showing that in the teachers opinion only two of these 8 pupils did work which was considered satisfactory, while four were considered inferior and two failures.

Of the 13 remaining pupils taking Physics 1,whose IQ's were from 100 to 110,I find that 8 made more than the median score of 60 on the subject test,that the average mental age was 16 years 7 months(ranging from 194 to 207 months),and that the teacher's term marks were 3B's,7C's,and 3D's.All in this group did passing work.

From the foregoing data on Physics 1 pupils I conclude that it is unwise for a pupil whose mental age is less than 14 years 11 months and whose IQ is less than 90 to take Physics. The results show that those pupils whose IQ is 100 or more and whose mental age is as much as 16 years can successfully do the work. This is not stating that a pupil whose IQ is less than 90 cannot do the work or that those whose IQ's are less than 100 cannot do the work,but it is merely stating that usually they do not do it. The writer has known pupils of low mental ability who by hard study and constant application have been able to do satisfactory work,but as a general rule it is inadviseable for them to attempt to master the subject of Physics.On the other hand,he sometimes has pupils of superior ability who from a lack of application or other causes do inferior work.

The Physics 2 class was so small that I did not include it in any of the tables.However,the statistical sheets show that there were four pupils taking Physics 2.Their IQ's were 116, 113,106,and 84.Their mental ages were 18 years 6 months,18 years 1month,16 years 11 months,and 13 years 6 months,respectively.Their scores on the Achievement Test were 76.1,59.6,36.7,and 17.7,respectively.The teacher's term marks were 2B's,1C,and 1 D.The subject test,the intelligence quotients,the mental ages,the teacher's marks, all show that the pupil with the high mental age and high intelligence quotient does the best work.The pupil whose IQ was 84 really had no business attempting to master the subject of Physics,and,the inferior grade of D given him by his teacher shows that he did not master it even to the extent of doing satisfactory work.

Table II,Column F,shows that there were 38 pupils taking Chemistry 2.The median IQ was 102.7 and the interquartile range was from 96.5 to 108.75.There were 8 pupils whose IQ's were above 109.Table VIII Column B shows that there were 9 pupils who made a score on the Achievement Test above 25.Table III shows that there were 9 pupils whose mental ages were above 17 years 1 month. Of the 9 pupils who made a score of more than 25 on the achievement test,the statistical sheets show that 5 had IQ's above 109,3 had IQ's above 100,while 1 had an IQ of 97.Of the 8 pupils whose IQ's were above 109 only three failed to be among the highest one-fourth of the class,two of the three being above the median score and one slightly below.Of the 9 pupils whose mental ages were above 17 years 1 month,I find that 6 are among those 9 pupils making the highest scores on the achievement test.Of the 8 pupils with IQ's above 109, the teacher has graded four A,three B,and one D.The teacher gave five A's among thirty-eight pupils and we have just seen that four of these A's were received by pupils whose IQ's were above 109.I may add that the other pupil receiving A for the term had an IQ of 108. The data given certainly shows that a pupil whose mental age is as much as 17 years and whose IQ is above 109 can successfully do the work required in Chemistry 2.

Referring to Table II Column F we find that there were 8 pupils whose IQ's were below 95.Table VIII Column B shows

that there were 7 pupils who made a score of less than 10 on the
Achievement Test.Table III shows that there were 7 pupils taking
Chemistry 2 whose mental ages were below 15 years.Of the seven pupils
who made a score of less than 10 on the achievement test,I find that
3 had IQ's less than 95,while the highest IQ of any of the 7 was 104
the other three having IQ's of 100 or less.Of the 7 pupils whose
mental ages were below 15 years,I find from the statistical sheets
that three were of the group who made less than 10 on the achieve-
ment test,while 2 made scores of 13,one 10,and one 21.All seven
made less than the median score of 18 except one.I find also that
the teacher's term marks for the 8 pupils with IQ's below 95 were
four D's,three C's,and one B.The four pupils receiving D as a term
mark had IQ's below 90.The three pupils receiving C had IQ's above
92,while the one receiving B had an IQ of 92.The data shows that
the chances are for a pupil whose IQ is below 90 and whose mental
age is less than 15 years to do inferior work.

Table II Column F shows that there were 22 pupils
whose IQ's ranged from 95 to 110.Table VIII Column B shows that
there were 22 pupils who made scores on the Achievement Test rang-
ing from 10 to 24 inclusive.Table III shows that there were 22
pupils whose mental ages were between 15 years and 17 years 1 month.
Of the group of 22 pupils having IQ's above 95 and below 110,I find
that 16 made scores above 15,the median score for this test being
18.Referring to the teachers marks,I find that he gave to this group
of 22 pupils a grade distribution of one A,seven B,seven C,six D,and
one E.The data tends to show that pupils with IQ's above 95 and mental
ages over 15 years do average work in high school Chemistry 2.

Table II Column E shows that there were 53 pupils
taking Chemistry 1,9 of whom had IQ's above 110.Table VIII Column A
shows that there were 13 pupils who made scores of 20 or more on the
Achievement Test.Table III Column E shows that there were 12 pupils
whose mental ages were above 17 years 1 month.Referring to the sta-
tistical sheets,I find that of the 13 pupils making a score of 20 or
more on the achievement test,5 were from the group of 9 pupils whose
IQ's were above 110.Of the 12 pupils whose mental ages were 17 years
1 month or more,I find that 8 were members of the group of 9 pupils
whose IQ's were above 110.The teacher's term marks for these 9 pupils
were 2 A's,2 B's,4 C's,and 1 E;showing that four did satisfactory
work,four superior work,and one failing work.The data seems to show
that pupils whose IQ's are 110 or more and whose mental ages are as
much as 17 years 1 month can do good work in Chemistry.

Table II Column E shows that there were 16 pupils
whose IQ's were below 95.Table VIII Column A shows that there were
15 pupils whose scores on the Achievement Test were below 10.Table
III Column E shows that there were 15 pupils whose mental ages were
below 15 years.Referring to the statistical sheets it will be seen
that 14 of the pupils whose IQ's were below 95 belonged to the group
of 15 whose mental ages were below 15 years.From the statistical
sheets it may be seen also that of the 15 pupils whose scores were
less than 10 on the Achievement Test,7 belonged to the group of 16
pupils whose IQ's were below 95.Of the remaining 9 whose IQ's were
below 95 only 3 exceeded a score of 11.The term marks given by the
teacher for these 16 pupils were1 B,1 C,4 D,10 E.When 13 of these
16 pupils(IQ below 95)make achievement scores of not more than 11
points,and 10 of the 16 are given term grades of E by a teacher who
did not know their achievement scores,it certainly seems conclusive
evidence that pupils whose mental ages are under 15 years and whose

IQ's are below 95 do not successfully accomplish the work of Chemistry 1 in high school.Only 2 received a satisfactory grade from the teacher and only 2 made as much as the median score on the achievement test(one of the three exceeding 11 made only 12 which was below the median).

Table II Column E shows that there were 28 pupils whose IQ's were from 95 to 110.Table VIII Column A shows that there were 25 pupils whose scores on the Achievement Test ranged from 10 to 20.Table III Column E shows that there were 26 pupils whose mental ages ranged from 15 years to 17 years 1 month.The statistical sheets show that 21 of the 26 whose mental ages were between 15 years and 17 years 1 month belonged to the group whose IQ's were between 95 and 110.It may be seen from the statistical sheets also that only 7 pupils out of the 28 made achievement scores as low or lower than the highest scores made by 13 of the 16 in the group having IQ's below 95.The teacher's term marks were distributed as follows:5-A,6-B,8-C,1-D,and 8-E.In the opinion of the teacher 9 pupils did inferior work.Of these 9 pupils 6 had IQ's less than 100. Judging from the scores made on the achievement test by these same 9 pupils,I think the teacher was correct in failing these pupils. However,since the majority of the pupils in the class with about equal mental age did the work successfully,I think these 9 pupils could have done it also if they had used their ability.

Table II Column D shows that there were 58 pupils taking Biology 2,of which number 13 had IQ's above 105.Table III Column D shows that there were 15 pupils taking Biology 2 whose mental ages were above 16 years 3 months.The statistical sheets show that 11 of the 13 whose IQ's were above 105 had mental ages above 16 years 3 months.Table VII Column B shows that there were 13 pupils whose scores were 35 or more on the achievement test. The statistical sheets show that 7 of the 13 pupils making scores of 35 or more were from the group of 13 with IQ's above 105,while 21 was the lowest score made by any pupil having an IQ of as much as 105.The teacher's term grades for these 13 pupils were 1-A,7-B, 4-C,1-E(no examination taken).Every one of the 13 pupils with IQ's of as much as 105 and mental ages of 16 years 3 months did satisfactory work except one who did not take the examination and therefore failed.The data seems to show conclusively that such pupils can do good work in Biology 2.

Table II Column D shows that there were 9 pupils whose IQ's were below 90.Table III Column D shows that there were 8 pupils whose mental ages were all below 13 years 9 months.Referring to the statistical sheets it will be seen that 7 of the 9 pupils(IQ below 90)had mental ages less than 13 years 9 months. Table VII Column B shows that there were 13 pupils whose scores on the achievement test were below20.The statistical sheets reveal the fact that of these 13 pupils 6 belonged to the group of 9 whose IQ's were below 90.The teacher's term marks for these pupils were 2-B,2-C,5-D,showing that the tendency was towards inferior work. The statistical sheets show that neither of the two pupils receiving B as a term grade made as much as the median score on the achievement test.

Table II Column D shows that there were 36 pupils whose intelligent quotients were between 90 and 105.Table III Column D shows that there were 35 pupils whose mental ages were between 13 years 9 months and 16 year 3 months.Tha statistical sheets reveal the fact that 34 of the 36 pupils whose IQ's were between 90

and 105 had mental ages above 13 years 9 months.Table VII Column B shows that there were 45 pupils whose scores on the achievement test exceeded 20.Referring to the statistical sheets it will be seen that 29 of the 36 made scores above 20 on the achievement test.Making a distribution of the teachers' grades it was found that for the 36 pupils they had given 13-B,12-C,10-D,and 1-E.The teacher judgments in conjunction with the results of the achievement test seem to indicate that a pupil having an IQ of as much as 90 and a mental age of as much as 13 years 9 months can successfully do the work required in Biology 2.The pupil receiving E from his teacher made 28 on the standard examination,the median of which was 27 for his class.

It will be seen by referring to Table II Column C that there were 108 pupils taking Biology 1.Of this number 26 had IQ's of 110 or more.18 of the 26 had mental ages of as much as 16 years 3 months.Table VII Column A shows that 23 pupils made scores on the achievement test of 30 points or more.The statistical sheets show that 17 of the 23 pupils making a score of more than 30 points belonged to the group of 26 with IQ's of 110 or more.I find that the term marks given by the teacher to the 26 pupils with high IQ's are,7-A,14-B,1-C,and 4-D,which shows that 21 out of 26 did superior work in the opinion of the teacher.There is no doubt about pupils of this mental age and intelligence quotient being able to do the work of Biology 1.

Table II Column C shows that there were 24 pupils whose IQ's were below 90.Table III Column C shows that there were 24 pupils whose mental ages were less than 13 years 9 months.The statistical sheets show that 16 of the 24(IQ below 90)had a mental age less than 13 years 9 months.The results of the achievement test in Table VII Column A show that 42 pupils made a score less than 20. Of the 24 pupils whose IQ's were less than 90,it can be seen that 15 belong to the group making less than 20 on the achievement test. Teacher's term marks are 1-A,7-B,1-C,5-D,and 10-E.In other words,15 of the 24 did inferior or failing work.The data shows a tendency for these pupils under 13 years 9 months mentally and with low intelligence quotients to do either failing or inferior work in Biology 1.

There were 58 pupils taking Biology 1 whose intelligence quotients were from 90 to 110.The lowest mental age of any pupil in this group was 12 years 4 months.The lowest mental age of any pupil,in this group of 58,who made as much as the median score of 22.2 on the achievement test was 14 years 2 months.The teacher's term marks were 7-A,25-B,3-C,15-D,and 8-E.The statistical sheets show that the 8 pupils graded E by the teacher had IQ's below 99 and the average mental age was 13 years 7 months.This agrees with the statement made in the preceding paragraph that pupils whose mental ages are below 13 years 9 months and have low intelligence quotients do inferior work in Biology 1.

Table II Column B shows that there were 64 pupils taking General Science 2,of whom 19 had IQ's above 100.Table III Column B shows that there were 17 pupils whose mental ages were above 14 years 7 months.Table VI Column B shows that there were 26 pupils who made a score of 20 or more on the achievement test.Referring to the statistical sheets,it will be seen that 13 of the 19 pupils(IQ-100 or more)belong to the group of 26 making the highest scores.The teachers' term marks for the 19 pupils were 1-A,9-B,7-C, and 2-D.In the teachers' judgments there were 10 of the 19 pupils who did superior work,while only 2 did inferior work.Certainly a

pupil whose mental age is 14 years 7 months and IQ of 100 or more can do the work required in General Science 2.

Table II Column B shows that there were 18 pupils whose IQ's were below 85.Table III Column B shows that there were 15 pupils whose mental ages were less than 12 years 11 months.The statistical sheets show that 12 of the 15 belong to the group of 18 whose IQ's were below 85.Table VI Column B shows that there were 19 pupils whose scores on the achievement test were less than 15. The statistical sheets show that 10 of the 19 belonged to the group of 18 whose IQ's were below 85.The teachers' term grades for these pupils were 1-B,8-C,6-D,3-E.A comparison of teacher judgments with achievement scores shows that 50 per cent did inferior work while only one pupil was rated superior by the teacher.

There were 27 pupils taking General Science 2 whose IQ's were as much as 85 but not as much as 100.Since it has been shown in the two preceding paragraphs that 27 of the two higher and lower groups have mental ages either below 12 years 11 months or above 14 years 7 months,the majority of this intermediate group of 27 pupils would have mental ages between 12 years 11 months and 14 years 7 months.Table VI Column B shows that 37 pupils received scores between 15 and 25.It can be seen from the statistical sheets that 18 of the 27 pupils with IQ's between 85 and 100 made scores between 15 and 25 on the achievement test.The teachers' term marks were 1-A,12-B,7-C,5-D,2-E.The teacher judgments when compared with achievement test results show that these pupils can do the work required.

Table II Column A shows that there were 7 pupils taking General Science 1 whose IQ's were above 110.Table III Column A shows that there were 7 pupils whose mental ages were as much as 15 years 10 months.The statistical sheets show that 6 of the 7 belonged to the group of 7 whose mental ages were as much as 15 years 10 months.Table VI Column A shows that 7 pupils made scores of as much as 25 on the achievement test.Three of the seven were from the group of seven having high IQ's.The teacher's term marks for these 7 pupils were 1-A,6-B.This group of pupils certainly can do good work in General Science 1.

There were 11 pupils taking GeneralScience 1 whose IQ's were below 85.Table III Column A shows that there were 12 pupils whose mental ages were below 12 years 6 months.The statistical sheets show that 5 of the 11 with low IQ's had mental ages less than 12 years 6 months.Not a single pupil of the 11 had a mental age exceeding 13 years 6 months.The statistical sheets show that the highest score made by any of the 11 pupils on the achievement test was 19;and,the lowest score 7.The distribution of scores was 1-19, 1-14.5,1-13.5,3-12,3-11,1-7.5,1-7.Only one pupil made a score of as much as the median for General Science 1 pupils.The teacher's term marks for these 11 pupils were 1-B,4-C,5-D,1-E.Both the scores on the achievement test and the teacher's judgments were low.In the writer's opinion,all except three should have been given failing marks by the teacher.The data shows rather conclusively that pupils whose mental ages are below 12 years 6 months and whose IQ's are less than 85 do very inferior work in General Science 1.

Table II Column A shows that there were 57 pupils whose IQ's were between 85 and 110.Practically all of these 57 had mental ages exceeding 12 years 6 months.Reference to the statistical sheets shows that out of the 57 only 3 scored less than 10 on

the achievement test.The teacher's term marks were 1-A,21-B,26-C,
4-D,and 5-E.The data shows that in general a pupil whose mental age
is as much as 12 years 6 months and whose IQ is as much as 85 can
do the work required,although a small percentage will do work of
inferior quality.

A study of the statistical sheets and the school rec-
ords shows that the majority of the pupils who dropped the science
they were taking during this semester had IQ's below 90.Some of the
pupils who took the intelligence tests were absent on the day that
the achievement tests were given and others had moved from Newport
News to other places.

Summarizing the analysis,I have drawn the following
conclusions:(1)A pupil having a mental age less than 15 years,and an
IQ less than 90 should generally be advised not to take Physics in
the high school;(2)A pupil having a mental age less than 15 years,
and an IQ less than 90 should generally be advised not to expect to
be able to do good work in Chemistry in the high school;(3)Pupils
with mental ages below 13 years 9 months,and IQ below 90 consistent-
ly do inferior or failing work in Biology;(4)Pupils with mental ages
below 12 years 6 months and IQ's below 85 do inferior or failing
work in General Science.A teacher,when advising a pupil,must take
into consideration other factors besides mental age and IQ.This data
is presented,not to show conclusively what pupils can do but rather
to show what a relatively large number did do.The conclusions stated
above are the lower limits.Pupils who are above the lower limits of
intelligence and mental age will do good work according to how much
they exceed those limits.

It is the writer's belief that soon all high schools
will have someone to help pupils outline the courses they wish to
take in order to complete their public school education,and that
this counselor or advisor will have sufficient test and other data
at hand to intelligently advise them.When we have every pupil doing
the things he can and wants to do,we will eliminate failure and at
the same time many of our present problems of discipline,etc.It is
our duty as teachers to bring this condition to pass as soon as we
intelligently can.

Table I

Score	A General Science 1	B General Science 2	C Biology 1	D Biology 2	E Chemistry 1	F Chemistry 2	G Physics 1
200-204	0	0	0	0	1	0	0
195-199	0	0	0	0	0	0	0
190-194	0	0	1	0	0	2	1
185-189	0	2	0	0	1	1	2
180-184	1	0	4	0	2	1	2
175-179	0	0	2	0	1	1	1
170-174	1	0	1	0	1	2	1
165-169	0	1	0	2	2	0	0
160-164	1	0	3	2	4	2	1
155-159	1	1	4	5	4	3	2
150-154	0	0	2	1	3	1	2
145-149	0	0	4	2	2	4	4
140-144	1	2	5	3	2	5	3
135-139	1	1	5	0	1	1	1
130-134	2	1	5	2	4	2	1
125-129	0	2	4	2	6	2	1
120-124	2	1	4	5	1	3	0
115-119	2	2	6	4	2	0	0
110-114	4	1	5	5	3	2	2
105-109	1	3	5	3	3	2	2
100-104	7	3	9	6	4	0	2
95-99	7	7	4	4	1	0	2
90-94	2	7	3	3	0	1	0
85-89	4	2	10	1	1	1	0
80-84	9	5	6	1	0	0	0
75-79	6	2	5	1	0	1	1
70-74	4	4	6	3	2	0	1
65-69	4	3	2	2	0	0	0
60-64	3	3	1	1	2	1	0
55-59	7	6	2	0	0	0	0
50-54	2	0	0	0	0	0	0
45-49	1	3	0	0	0	0	0
40-44	1	1	0	0	0	0	0
35-39	0	0	0	0	0	0	0
30-34	0	1	0	0	0	0	0
25-29	0	0	0	0	0	0	0
20-24	1	0	0	0	0	0	0
Total	75	64	108	58	53	38	32
Median	84.7	91.4	111.0	114.0	131.9	143.0	145.0
Q1	69.7	68.3	87.5	98.1	110.4	122.5	110.0
Q3	103.8	106.7	139.0	140.8	158.4	159.2	160.0

Read the table thus: Of the 75 pupils taking General Science 1, 1 made an average score of 180-184; 1 made an average score of 160-164, etc. The median score for General Science 1 was 84.7; the interquartile range was from 69.7 to 103.8. Read similarly for the other six subjects.

Table II

Intelligence Quotients of 428 Pupils

IQ	A General Science1	B General Science2	C Biology 1	D Biology 2	E Chemistry 1	F Chemistry 2	G Physics 1	Total
140-144	0	1	0	0	0	0	0	1
135-139	0	0	0	0	0	0	0	0
130-134	1	0	0	0	0	1	0	2
125-129	0	0	0	0	0	0	0	0
120-124	0	2	3	2	0	1	2	10
115-119	3	1	9	1	3	1	1	19
110-114	3	0	14	2	6	5	4	34
105-109	6	5	16	8	10	6	5	56
100-104	8	10	11	8	7	11	8	63
95-99	15	6	18	14	11	5	2	71
90-94	10	13	13	14	10	4	6	70
85-89	18	8	15	3	2	2	2	50
80-84	7	10	8	5	2	1	2	35
75-79	3	5	1	1	2	1	0	13
70-74	0	3	0	0	0	0	0	3
65-69	0	0	0	0	0	0	0	0
60-64	0	0	0	0	0	0	0	0
55-59	1	0	0	0	0	0	0	0
Total	75	64	108	58	53	38	32	428
Median	94.3	92.3	99.7	97.1	99.8	102.7	102.5	
Q1	87.2	84.0	91.1	92.0	93.6	96.5	93.3	
Q3	101.4	101.5	109.7	104.1	107.9	108.75	109.0	

Read the table thus:Of the 75 pupils in Column A taking General
Science 1,15 had IQ's of 95-99;the median IQ was 94.3;the inter-
quartile range was from 87.2 to 101.4;etc.Read similarly for the
other six subjects.

Table III

Mental Ages of 428 Science Pupils

Months	A General Science 1	B General Science 2	C Biology 1	D Biology 2	E Chemistry 1	F Chemistry 2	G Physics 1
225-229	0	0	0	0	1	0	0
220-224	0	2	1	0	1	3	3
215-219	1	0	6	0	2	2	2
210-214	1	1	1	1	3	2	2
205-209	2	1	5	5	5	2	2
200-204	0	0	4	4	7	4	3
195-199	1	2	9	5	4	8	7
190-194	2	2	9	1	4	3	2
185-189	2	3	7	4	7	3	1
180-184	4	4	9	10	4	4	1
175-179	4	9	10	6	5	3	3
170-174	13	10	14	8	5	0	3
165-169	6	6	9	6	0	2	1
160-164	13	5	10	1	1	1	0
155-159	7	6	3	4	2	0	2
150-154	7	6	2	3	2	1	0
145-149	9	3	0	0	0	0	0
140-144	2	2	0	0	0	0	0
135-139	0	2	0	0	0	0	0
130-134	0	0	0	0	0	0	0
125-129	0	0	0	0	0	0	0
120-124	0	0	0	0	0	0	0
115-119	0	0	0	0	0	0	0
110-114	0	0	0	0	0	0	0
105-109	1	0	0	0			
Total	75	64	108	58	53	38	32
Median	164.4	167.0	178.3	180.5	190.6	196.25	197.1
Q1	154.8	154.2	166.1	170.3	178.25	183.1	176.7
Q3	174.3	176.25	194.4	192.5	204.1	204.4	207.5

Read the table thus: Of the 75 pupils taking General Science 1, 13 had mental ages of 170-174 months; the median mental age was 164.4; the interquartile range was from 154.8 to174.3 months; etc. Read the other six columns similarly.

Table IV

Chronological Ages of 428 Science Pupils

	Gen. Sc.1	Gen. Sc.1	Biology 1	Biology 2	Chemistry 1	Chemistry 2	Physics 1
The oldest pupil	17-9	18-9	20-1	18-8	20-1	18-10	19-2
The Youngest "	12-11	12-11	12-9	13-10	14-6	14-3	15-3
Between 20&21 years	0	0	1	0	1	0	0
" 19&20 "	0	0	1	0	4	0	2
" 18&19 "	0	1	2	1	4	6	4
" 17&18 "	2	6	12	5	11	16	12
" 16&17 "	11	13	18	19	25	7	11
" 15&16 "	15	15	29	23	7	8	3
" 14&15 "	29	25	28	8	1	1	0
" 13&14 "	17	3	16	2	0	0	0
" 12&13 "	1	1	1	0	0	0	0
Total	75	64	108	58	53	38	32
Median	14-8	15-2	15-4	15-10	16-9	17-2	17-2

This table has been inserted chiefly to show the general
distribution of the ages of pupils taking science in this high
school for this session.It will be seen that the ages of the
pupils increase according to the order in which the four sciences
are at present being offered.It has been the custom in recent
years in this high school to allow only third and fourth year
pupils to take Chemistry and Physics.

Table V

Actual Term Grade Distribution of 428 Science Pupils

Mark	General Science 1	General Science 2	Biology 1	Biology 2	Chemistry 1	Chemistry 2	Physics 1
A	2	2	15	1	7	5	2
B	28	22	46	22	9	11	6
C	30	22	5	18	13	10	9
D	9	13	24	15	5	11	11
E	6	5	18	2	19	1	4
Total	75	64	108	58	53	38	32

A mark of A is supposed to represent work whose quality exceeded the expectations of the teacher and to show that the pupil possessed initiative and a spirit of cooperation to a marked degree.

A mark of B represents that the pupil did work of superior quality.

A mark of C represents that the pupil did the work of the class in a satisfactory manner.

A mark of D represents that the quality of work done by the pupil was inferior.

A mark of E represents that the pupil did such poor work that he will have to repeat the course in order to receive credit.

	Table VI				Table VII	
	Ruch-Popenoe General Science Test				Ruch-Cossman Biology Test	
Score	A General Science 1	B General Science 2			A Biology 1	B Biology 2
50-54	0	0			1	0
45-49	0	0			0	0
40-44	1	1			4	7
35-39	1	1			4	6
30-34	1	0			14	8
25-29	4	6			16	13
20-24	6	18			27	11
15-19	27	19			22	8
10-14	30	15			17	5
5-9	5	4			3	0
0-4	0	0			0	0
Total	75	64			108	58
Median	15.5	18.4			22.2	26.9
Q1	12.3	14.0			16.6	20.7
Q3	18.9	22.8			28.8	34.1

Read Table VI thus:Of the 75 pupils taking General Science 1,27 scored 15-19;the median score was 15.5;the interquartile range was from 12.3 to 18.9;etc.

Read Table VII thus:Of the 108 pupils taking Biology 1,27 made scores of 20-24;the median was 22.2;the interquartile range was from 16.6 to 28.8;etc.

Table VIII

Powers General Chemistry Test-Form B

Score	Chemistry 1 A	Chemistry 2 B
40-44	0	0
35-39	1	1
30-34	0	2
25-29	4	6
20-24	8	7
15-19	6	9
10-14	19	6
5-9	14	6
0-4	1	1
Total	53	38
Median	13.0	18.3
Q1	9.4	12.1
Q3	19.8	24.6

Read the table thus:Of the 53 pupils taking Chemistry 1,8 made scores of 20-24;the median score was 13.0;the interquartile range was from 9.4 to 19.8;etc.

Table IX

Sum of Scores on Forms A & B-Iowa Physics Test

Score	Physics 1	Score	Physics 1
165-169	1	35-39	0
160-164	0	30-34	3
155-159	0	25-29	0
150-154	0	20-24	1
145-149	0	15-19	0
140-144	1	10-14	2
135-139	0	5-9	0
130-134	0	0-4	1
125-129	0	Total	32
120-124	0	Median	60.0
115-119	0	Q1	42.5
110-114	0	Q3	80.0
105-109	0		
100-104	0		
95-99	2		
90-94	1		
85-89	1		
80-84	2		
75-79	4		
70-74	2		
65-69	1		
60-64	1		
55-59	1		
50-54	3		
45-49	3		
40-44	2		

Read the table thus:Of the 32 pupils taking Physics 1,2 made scores from 10-14; the median score was 60.0;the interquartile range was from 42.5 to 80.0;etc.