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Box 15, Folder 30 - "Geometry" (E.M.S.)

Edwin Mortimer Standing

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Geometry 1953 June 23

Geo graphy
Geo lugsy
Geo metry

a common part. —
(also a Revision!)

How?

In Egypt

interesting for adult children

then came to Greeks

"Travelling on to continent"

When says turned to Egypt for their love

Greek mind — intellectual

Raised it to a science

of Rope + 3 sticks — it angle

Theorem of Pythagoras



~~how~~ rope — turns into a "line"

Plato "let no one ignorant" etc.

We begin far earlier than Plato
with a different purpose

Seasonal Geometry

You know.

Just a few points

① Following to Containers.

There is first to general most of to hand & arm in taking in & pushing back proper.

But this is not enough.

We must teach to do to make a movement more determined more accurate more co-ordinated. So we teach him how to feel round to contain of to figure distinctly with to first 2 fingers of the right hand, steady - accurate, & also round to contain of to correct so on.

We must teach him to take deliberate & accurate making is done.

The reason for this is that to attention of the child. Should he make to feel an easy familiarity of the fig. he is feeling - thus working to store as stroke with visual sense.

The mind has to follow a line exactly & to little and it is a definite. In fact we shall see him feeling round to meet and longer it exactly. So we shall insist. not by force or severity but by showing to do. to more accurate way until he does it.

This insistence means that no other result to present. So instead of looking to hand (accident to to supposed danger & 1 of matter) I present.

It is not a punishment - a d. is. to 3
punishment my interests in the personal
interests to ch. might be hurt if left
alone.

It C. may be surprised - ask my?
perhaps you will sympathize with it!

But nevertheless I persist. In this
case I am being done like an old. Teacher.

You may ask 'Why not let it be as it
is, or as I like + let the children develop
as they please. I reply: 'at the present
moment, as we see, this little hand finds
great difficulty in making and to direct.
But this little hand - being the hand
of a civilized person - will be long have
to write. And to write means to follow
certain definite movements not easy to
make; and how will this little hand be
able to do it if it came even so this?
So then it is an act of love towards this
little hand to prepare it at a distance
for a day yet to come. And it is much
easier with the wrists to teach children
already there. Finally we shall see that
the ch. has mastered the technique + it becomes
a great pleasure to him to feel the curves.

- 2) Don't be afraid to teach long names
 "Prepus Neluchadnozor to Toe!"
- 3) Keys to Unusual -
 The Cardinal.
 Don't force - let it come naturally

② Metal Insets

Main forms + combinations
 aesthetic
 (so other than combinations)

③ Divided Triangles

Geometry not like Reading & Arith^c
 we depend on something already announced
 alphabet - D system.
 "a study in wh. to mind is independent"

④ Geometric View of Numbers

⑤ Advanced Geometrical Material

- 1 Metal
- 2 Fewer Figures
- 3 Common Point of Reference
- 4 Figures are divided

The Aim

↳ main - facilitate to C. auto-education
 - less exercises in Geometr. - & also the
 real problems.

Not primary to teach this or that

Strengthen the reason
character

give clear ideas

increase mental capacity

Comparison with these Games of Palenme

Picture - Puzzles

filling vessels

no 2D^o curis

These have

So To Open up a Path

A Way of Discovering

Self - Development

• i have no admirer

PRESENTATION

Square.

Rectangles Triangles.

Put them out.

Wander on.

Put out.

Identical

Similar

Equivalent.

A Great Step

From Sense Judgement

to Reason

Now a PROBLEM

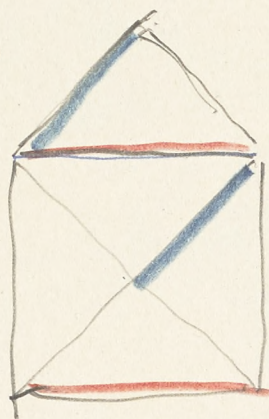
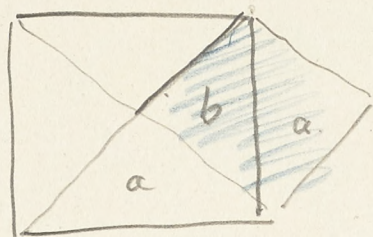
Putting out to Pagoda!

A New Problem!

The material is a sort of ferment
to the mind.

Eg

Blue Sq. = $\frac{1}{2}$ other one



The Best conditions for Making Discovers

Read pass 12 - 13 - 14 half-way

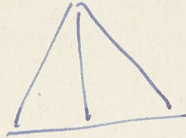
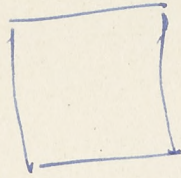
again page 20 - 21 - 22 -

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CONTRACTED THINKING

New Lines are Born

eg Diagonal



and ~~so~~ we need words to describe our discoveries

So a Parallel Exercise

Cards with figures
definitions
and Art

Always this combination

Ask P. W. To describe

Angela's work

Exercises in Drawing

set ruler
square
compass
protractor

Flight into Abstract

a spontaneous flight

comes from

a) Clarity & knowledge in
concrete

(b) Maturity.

4 Years later

Sensual not given as first stage
given - each - for a present need.

"Not only strengthens his
basic terms
& concepts,
acquires higher & clearer ideas
Abstract-ideas

" In his succeeding flights into the
abstract. he will show surprising ability
to grasp.

When a high school ch. is still
wasting his mental effort trying to
understand the relationship bet. geom figs.
which it seems impossible for him
to understand, our ch in the elementary

Grade is "Judging and so himself" yes &
So clearly his discern that he
immediately begins to search for
other geom. relationships.

Our ch. gallop along freely along
over a smooth road, urged on by the
warm energy of their strong presence
organism, which may allow ch.
plod in barefooted, in shackles over
slimy paths"

They are ready to enter Plato
Academy.

Pass

July 9th 29

(1)

Geometry Advanced.

Geometry Compared with Arith^c + Writing

When we speak of Reading + Arith^c we depend on something already arranged — the alphabet + the Decimal System. — but there is a study in which the mind is independent — Geometry.

Stages in Geometry

a) Sensory Geometry. The comparison + recognition of Geom. figures — Sensory study. forms recognized by Touch + Sight.

b) Geometric Figure Drawings (for Writing)

Through (a) + (b) children did really study the relations between the figures. + combining them produced aesthetic compositions.

c) Advanced Geometry

We are now in another period — more advanced but connected in the child's mind with the earlier period. But this is the beginning of a quite new study.

Characteristics of Adv. Geom. Material

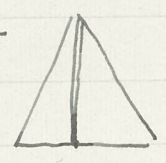
- 1) Geom. figures have a mount or frame (not deep — plain surface) pt of referents.
- 2) Figures are divided + subdivided.

These figures ~~are~~ are divided in parts wh. can be compared with each other + the whole. Parts can find their place in the figures. — See the Great Principle — to get to the bottom of anything we must analyze the parts + know their relation to each other + the whole. So we not only can displace the whole figure as before — but the figure can be decomposed + recomposed

New Lines Born.

" This possibility of dividing up the figures brings to light new lines which could not be known before in the old way of feeling round with the hand.

Example



A Triangle divided into 2 parts by a line. How often we say there is a line which divides a Δ into two equal parts.

Correspondence of Figure

The three figures    must correspond.

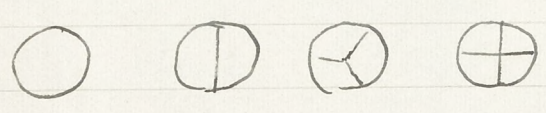
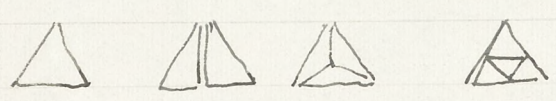
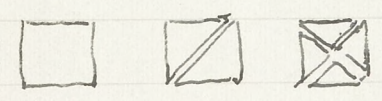
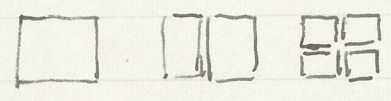
Common is :- Diam, Side of Δ . Side of Square.

Thus \circ can be inscribed in \square

Δ cannot be inscribed in \circ . too big & does not reach top of square.

Equal Similar Equivalent Figures

We Divide these figures into equal parts.



5 6 7 8 9 10.

Special Study of Lines & Angles

Study of Aesthetic Fund - make ornamentation on the Diagonal. Diameter. Base etc. This design makes them pause over the matter.

Also a sign for - as in the old geometrics.

This includes & accompanies the Definition of these lines.

Equal Figures

Take the Square for Example. Dividing it we come to figures sometimes similar sometimes not

1) rectangles 2) squares -

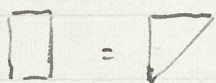
But dividing Δ^s come always triangles.

So we can arrange

Equal + Similar figures.

Similar small sq. & large sq. If photographed & enlarged would come to the same thing.

Equivalent Figures



From Sense to Reason

Now this is no longer a Sensorial exercise -

It is a matter of Reason. [Each is half of the same square]

Nature so the senses not tell us - but there seems a conflict between the eye & the Reason fr.

This realization of a fact come to by the Reason stands for a great advance - a progress compared to what has been done earlier. For it is the intelligence which has to be exercised here in the question of equivalent figures as it was the eye which recognizes those which seemed alike in the Sensory stage.

Reason Requires a Point of Reference

For these Equivalent figures we refer back to the equal squares from wh. they are derived. So we can reason when we have this point of reference.

And one can reason by oneself alone - For this fact of the common frame is our guide - a point of reference - allows us to progress - always working.

A Control of Errors. A Compass

So - just as we had 'a control for the sensory material for geom.' here also this point of reference acts as a control of error.

A Problem in Geometry

The Equivalent Figures are not similar in series. - the Triangles yes - but not the rectangles & squares alternating

Can we turn the second series into a series - descending of similar figures
How to do it?

A Problem.

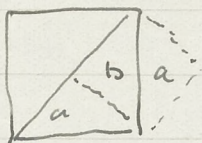
It would certainly be more aesthetic.

A Problem - cannot be done by the Senses
but only on the Plane of the Intellect.

Yes when I am given this material it is not that I must imagine the solution ^{them}
I must reason about them.

So now I am in a position of one who is about to make a Research.

Relations of Squares & Circles



Square $a+b = \frac{1}{2}$ big square

So Circle in big square is double circle in small square (which is inscribed in its big circle)

Example: of Theorem

Some can see "If a square be inscribed in a circle & another circle inscribed in the square. The second circle is half the first."

Assisted by the manual it is possible to discover & work out many such problems with no more stress or effort of intelligence than that required to do the multiplication table or the grammar.

Naturally the manual is necessary through which these facts are made to stand out -

Manual is easy to handle & the frames - as a lot of reference - are a great help.

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Geometry (Cont-d) XL III

Method with Advanced Material

Learning is a co-efficient - makes part of the parallel Exercises - that which is learnt serves as a means to (basis for) reasoning.

Reason its own Rhythm

Explosions

Reason has its own characteristic manner of working - its possibility of remaining a long time over one thing; or even leaving it to take it up later. Then the reasoning leads to interesting conclusions which may suddenly appear like a light revealing noble elements in objects in front of us.

This kind of reasoning is banned in ordinary school - this free road to reasoning.

Explosions

We do not force the Geom. Conclusions just as we do not force the mind to

52

The sky is blue

P. T. J

Rhythm & Reason

All these little equations represent so many little spurts to a mind which reasons, which must work to satisfy a need, to reason. All have need of a continuous work which goes according to our own inner rhythm - without anyone hurrying us on - without any end that we must reach by a certain time.

Indeed it is splendid when the end reached comes unexpectedly + causes enthusiasm

Object of Geom That

So then Reason is the end

The Material it means - the

The work is an aid to the reasoning
& ~~to reason is to live!~~

& Reason is the life of it
(ragionare è il vivere)

Discovery

Geom & Fractions

44

Fractions

Fractions as Decimal
Areas Equivalent

Si Impara shada faciendo

Do one can say that Δ^s which
have the same base & the same height are
equivalent amongst themselves — so a
Theorem has sprung up — no longer a
mere consideration of equivalences.

It is —

Something learnt as one goes walking
along

Solictur ambulando

and

Inventus ambulando

Culture + Development. a Genl Principle

One of our general principles is to give a material wh. introduces to C into a line of development (not a "Subject")

Example - Geometry Thus when we say we have a material for Geom. it does not mean that the material serves only + directly for this -

[You see why it pays to copy it out : it sinks in!]

In other methods to Subjects divide in a Progress way - not with us.

In all ^{the} things we give we give we ind a complex synthesis of various developments which combine

Elementary Geom. Material Not for Geom. Brief

It serves to give to C. handling + familiarity with Geometric Forms ~~as~~ - as we have geom forms all around us.

Analagous Material for Drawing

Metal nests. - Writing designs.

All this could not be called geometry but it opened up a path of development

Geometry + Mathematics Join

[So, Geom. + Envt Forms

Geom. and Writing

Geom. + Creative Designs

Geom. + Arith.

]

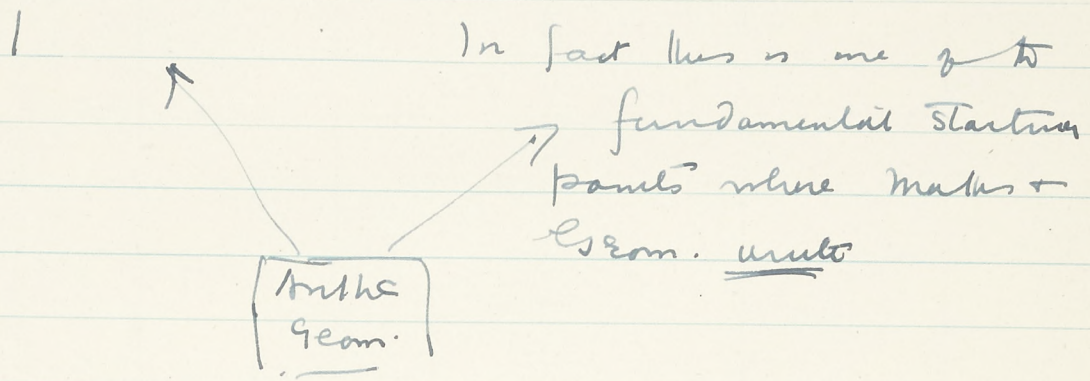
When we give to heads (to) in the form of squares we give Geom ideas.

In the El. Geom Mat. we give greater precision to what has already in Envt.

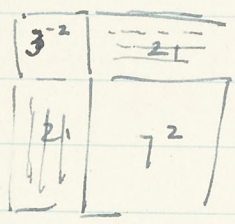
In to find material we give to geometric 9
 aspect of Arith^c. — Because we know that
 pure maths is abstract!

Relation Between Abstract Ideas of No. + Mat Form

When to this abstract idea of number
 we give material ~~from~~ quantity we come
 to the geometric aspect of Arith^c



In the time of the Desert of Decimal System the need
 to put everything on a Geometric Basis (?)



Thus to unite may present both
aspects together maths + geomⁿ

Up to a certain point Geomⁿ may
 be considered as a material which unites maths

A Live Geomⁿ

Consider Geom. this way it is not to be such
 an end study —

Advanced Geomⁿ Material 8-9 years

A gap of four years! "Nothing better than how mat^e
 shows our purpose is not to lead to C. step by
 step along a certain rule just to teach him to
 welcome one logical abtⁿ after another in a st line.

It is not that because to C. has understood
 the first Geom material can understand to second

Difficulties & Maturity

10

One understands a difficulty only when the mind has reached that maturity that it understands, +
not simply because it has understood a past difficulty.

Our purpose is not to lead the mind thro' these difficulties but to respond to the needs of the

Though the C. of 4 can recognize & name Polygons it does not mean he is able to understand about their angles & relations: This comes at a much later stage.

For this reason we must not be frightened if we do not go step by step from one point to another. ["Spiral Development of Mind!"]

Later - 8-9 years We give study of line & figure & teach definitions - not because it is logical to give these now but simply because the C. is ready & interested, & his mind is mature enough to go into these details

11

Sensory Geometry

This multiplication of figures in different ways gives him the possibility of recognizing the same figures in different aspects

Touching to Outlines

This is a lesson to be taught. I insist like an ordinary teacher.

It is not natural to touch in this particular way.

But when we have taught we find the child when touching in this way.

So much so —

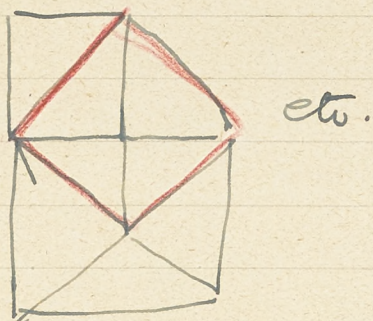
Begins spontaneously to touch with his eyes shut.

This shows his need for it.

Geometry (Contd.)Method Natural a Ferment

This Observation & Manipulation has
in it a kind of fermentation i.e. strange
action on the mind

Various lines of research

Example of an Explosion

A boy knew this figure & was enthusiastic
because it represented a square which had its
diagonal equal to the side of another & was the
half of this. & said to his friend

"Look this figure is interesting because it has
a diagonal = to the side of another." — &

The other said:—

"How curious - this square! its side is
equal to half the diagonal of the other"
& the first said "You have made discovery
who knew that before?"

Why did not the first discover it?

Because his mind was already fixed on the
other fact - & so did not see the other particular

Instead a person with no preconceived idea,
saw it suddenly. — Just as —

The Too-fixed Mind

A little thing which fixes too much the
mind prevents one seeing something
under one's very eyes.

The Best Conditions (Again)

The conditions of the best well-being for
discovery things is to have the mind unburdened
("at leisure from itself") for thus quiet going
along — for reflexion. Thinking without
fatigue is the most favorable condition for
making discoveries the biggest discoveries.
He who is worried or agitated is not
likely to make discoveries.

This mental work, then the work on
to discover to find out its reason — to make
deductions. But already the first must
be the contact between the facts & their relations
in the mind which is favored in this singular
way by this species of repose & vacancy

of
Catholic
Church
or
pt of
reference

This fact of having a point of reference
which is always the same & of being able
to make more & change these points so easily
refers things to possibility of a sure & pleasurable
spontaneous study, which one can undertake
accompany with like designs as I have done

Parallel Exercises Geomet^y Adv.

This figures stimulate the mind to translate ones observations into words — so for this we must teach the names of words. Thus we see these 11 exercises always give the possibility not only of going in the straight road of observation but also of going forward in towards perfecting the exactness of ideas + the expression of them.

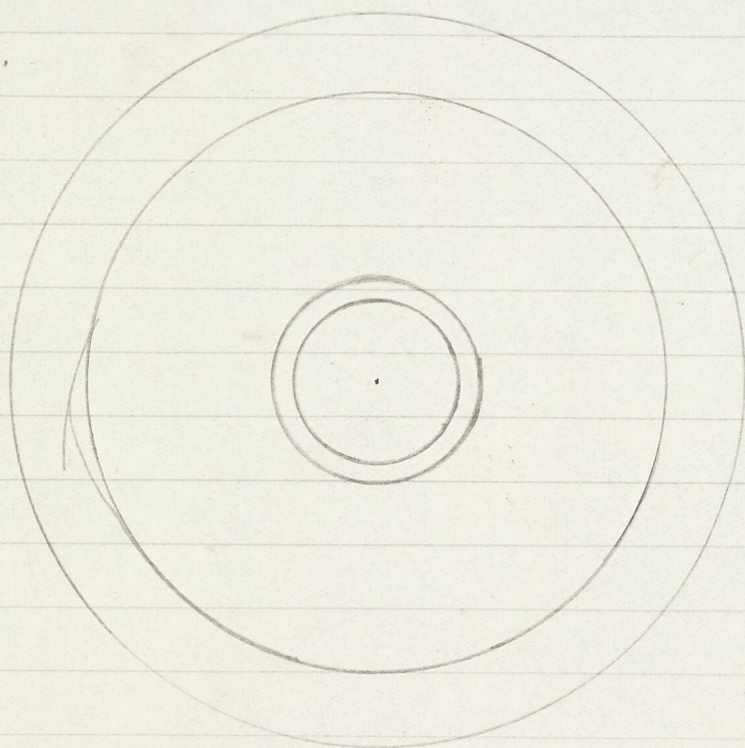
Discipline of Mind

Working with these figures an infinite number of things come out; and here as in all subjects which one will learn — it is necessary to eliminate useless things + to keep to those which lead to a sure & certain road and a definite end.

This development can only come with material for the student to manipulate: it would not happen if the master held the material at his disposal to explain the relationships of this or that + then put them away. These things can only come when the child can take the things which interest him + test & retest them along with that inner activity which comes from his interest. In this way one discovers many things.

~~Parallel~~
Parallel Exercises

See Geom. Axioms. Led 41/2



Teacher

16

The Light Touch

See geom. Advanced

Let 40 / 5-6

Advanced Geometry

First Stage

We did not teach anything.

Put material in hands for a child.

1) Keys to Unruse

The seasonal exercises of recognizing the forms led to an interesting observation in the environment. (Examples)

- 2) In consequence the geom. figures have returned to the children as models for drawings - have combined many figures.

Advanced Stage

Still do not teach.

This criterion we do not radically change is in the sense of not teaching, or setting ourselves to problem if we should teach or not.

We give these objects as means for the exercise of the Intelligence - which intelligence - especially in the growing child - has always the need of a reproful activity over some sort of material

To reason over the material if it can, make observations, comparisons if it can - and if it doesn't you can't give it the faculty of reasoning if it hasn't got it.

And anyway to have these figures under ones eye is no harm.

cf Grading the Colours

Scope of Material

18

So then we have the principle of placing before the child a material which gives the possibility of thinking, observing & comparing according to the limits of the individual's capacity. Because these observations prepare the ground for anyone who wants to reach ^{2.9} logical definitions.

What Not To Do

Some might think (1) it necessary to begin with the idea of a point generating a line
a line a surface
a surface a solid -

we would say this was too advanced a concept for a child.

[All the same our children wd. use to it better than most, as they have seen this in the Decimal System of Beads.

- or - (2) Begin with a line as an abstraction

[And even here our children wd. have a better chance - the one line with the inset & its socket! - also touching the lines with wooden sockets.]

Material Can Help to Prepare for Ideas

So one can prepare a material in such a way that it makes order in the mind & prepares it to receive such ideas - although the scope of the material was not

Something Must Be Taught

- E.g. 1) The Names
- 2) Special lines we have traced as parts of the figures

Because if things have a special name we must teach the names.

- Because -

Judgement Precedes Syllogism

When we have come to so advanced a pt that we can reason over the figures it is certainly necessary to teach the names - because without them how can one reason of the things, or show the relations of one to the other.

The names are for explanations to oneself.

Teach Names by a Parallel Exercise

But these teaching of names is not done as a dry preamble - ^{so} now we will learn the names of things + then begin to look at the things to reason on them. How can one teach the names of things one doesn't know! or know without interest.

So we give parallel Ex.

- 1) One on side objects wh. arouse interest.
- 2) On the other various exercises in drawing + in learning of the names - other part (2) becomes the aid in so far as there has arisen interest in the figures themselves + their relationships.

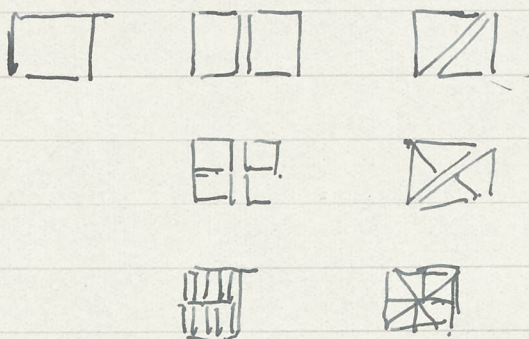
Advanced Material More Limited

Whereas the little ones have seen a great number of diff't figures - triangles rectangles circles sq. squares etc - to fill out the whole floor - here we are limited to a very few figures.

we go from many to few - that mind which in the first stage was able to fly over a great variety of things now developing itself further fixes & limits itself.

[Principle. Sensual Many Things
Intellect limited to fewer]

Description of Material



Secret of Progress

We are not content to speak of lines, or designs, but will remain in the most ignorant manner on these figures without knowing anything - or acting as if we knew nothing, not inquiring ourselves in these lines, nor names, nor angles etc.

It is more interesting that all these put out - make a pretty effect - and that this has grown the possibilities of wishing to know. Because

40/4

Because in its pretty effect . or in simple things -
when one puts on oneside the necessity of having
to think or to know in a prefixed manner -
when one rather allows the mind to repose in
its ignorance - in this lies the secret which
leads to the most rapid progress.

Because the real rapid progress can only
be made when one creates from within

For who does not know that when one wishes
to study one places oneself in some spot where
one can be in silence and apart from people -
even tho' they can make the most ingenious questions.
Because these would disturb this precious work
which must be respected - especially in the child -
because such are the best conditions for work

The Teacher & the Light Touch.

But a slight touch is necessary to direct the
observation to those things which in themselves
carry the possibility of leading to discoveries.

This touch is necessary: So then the Teacher
must have the ability to give just that
little assistance sufficient to put in
living rapport the intelligent & ravenous
spirit of the child with the object which
leads to this inner work.

Equal Figures } by the Sense
Similar Figures }

Equivalent Figures & Law of Reason

In this distinction sense no longer enters: in fact sense is a hindrance - seems to contradict the reason - This is perhaps the first step in the new phase - This different road - in which to reason discovers the value of things - & to senses no longer

Not to Hurry on - To Digest - Rest

The important thing is not to finish the business when the thing has become very clear & has been repeated in analogous exercises. But it is important to hover around still - doing parallel exercises making many drawings on these objects. We must get the child to remain brooding over these things - without making a tiring effort of reasoning. - even in fact going a step backward from the reasoning.

The child must dwell on these things, drawing them, ornamenting them, making ~~too~~ combinations - ~~for~~. It must remain on these things because everything is a result of a marriage between these things, which contain in themselves the possibility of a slide of relations; and a mind which thinks. Everything happens between the things & this mind. But in order to bear fruit the mind must remain brooding hovering dwelling over - or in the presence of these things. A more developed

would get bigger things out of them & a less developed mind small & more simple things.

Thus the world is always the same but the mind of man - as it goes along - has seen more & more things -

Thus then the important thing is that there be.

- 1) Objects which present exactly the relationship between things and -
- 2) A mind which can see them

Cannot Force to Reason

It is evident that if the mind is educated with a face contracted, a brain contracted & contracted because some one is obliging the mind to think; if this is the pain of having to learn & know in the manner wished by the other person - this (contracted) mind cannot discover anything - unless we give it a rest - cure & liberate it from this anguish & let it become calm according to its nature.

Give Serenity not Ideas

It is this Serenity which is necessary to give - not new ideas; if this serenity is there - that is enough.

July 18th

24

An example to show that mat.^l helps to reason.
We shall begin to reason. Rec. from outside
seems only a few figs & few divisions

1. Equal Δ is divided in 2, 3 & 4 parts

① In 2 $2 \text{ rt } \Delta$'s.

② $\rightarrow 3$ 3 obtused Δ & 4' - (osc. -

③ $\rightarrow 4$ 4 equal Δ . similar to parent.

Thus Δ is not a Δ inscribed in \circ .

Its side = diam.

Then $2 \text{ rt } \Delta = \frac{1}{2}$ leg Δ .

Put together a rect angle. $\square = 16 \Delta$

Rect. normal



This other is more
harmonious in its form.
& is made of 2 halves of
an equal Δ .

It is of a form which we call golden
being artistically beautiful. This rect.
~~one~~ enters the circle. Have taken 1 for
figures wh. had a common dimension.
3 figs $\square \Delta \circ$ had one in comm.

Diam of \circ : 1 side Δ - 1 side of \square

Comparing them - it gives a harmony of
proportion.

In all these cases of Geon^s is an aesthetic 25
side wh. we take into consideration.



Here is Δ divided in 3. here is - 4.

Taking out 1 I have a trapezium.

If I take out a second Δ have a rhombus
 $= \frac{1}{2}$ of Δ . \therefore This $\Delta = 2$ rhombuses.

This rhombus has as longer side the height
of the Δ . & ht of rectangle.

Which is inscribed in rectangle.

And this rhomb. inscribed in rect is
a thing aesthetically perfect. Eye can appreciate
this harmony. We can form by combination
a perfect harmonious design by studying
geom^y. The little classes combined acc^t
to own taste: these here are combin^s based
upon the correspondence - a study
intelligently aesthetic - not only of senses - but
intelligence. This rhombus is half the
rectangle.

Trapezium $= \frac{3}{4}$ of Δ

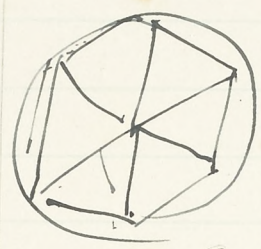
Starting this way for equal Δ we have
arrived at v. forms, rect, rhombus,
trapezium. All these are related - have
something in common. It is not a
study of figures as in early stage

simply rearr. & compare - it is the
grouping & combining figures.

Some can realize. equivalence of
figures & equivalence of surfaces. or
relation between.

E.g. this rhombus = this Δ

If I put 2 like Δ in a circle
I make a hexagon.



So hex. = Δ + rhombus.

So we enter on the study of Polygons -
beginning w. this regular one whose sides =
to radii.

This polygon = $1\frac{1}{2}$ triangles
= 3 rhombi.

Co. make a drawing.

Now this Δ in 3 parts

Let us take out 3 parts.

& put on side \rightarrow forms a hexagon

hex. $\therefore 2$ = sides inside Δ now lined
out + instead of 3 sides 6 - hexagon.

Similarly to one before but no equal
hex = twice Δ .

So diff a hex 2 hexagons is 1 rhombus

Place these hex. on top consider

The frame between the 2 = 1 rhombus.
 This may have a value for an aesthetic
 pt of view. Frames ^{or} rh. we surround
 may have a certain harmony or what is
 contained. If I turn round I should
 see 1 inscribed in 16 others.

Inner hex = $3/4$ and since diff is
 1 rhombus - extend it to inner 3.
 So inner hex = $3/4$ larger.

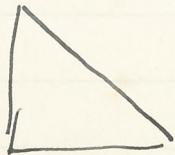
So a hex. inscribed in another hex = $3/4$
 to larger one.

So if 2 hex 1 inscribed 1 circum' in O.
 proper is as 3:4.

Big Δ - Δ = rhomboid. middle one
 = $3/4$.

Now relate between side of inscribed Δ + other
 one.

That Δ Δ triangles on Δ - Since Pythag
 to we could say it is general. - a
 special case.



Some enter the field of polygons.
 So although we have started from 3
 by means of these we come to
 consider ~~not~~ ^{many} others

Now let us consider something more
 useful. I saw in Dealing with Geometry
 it is not necessary to have any stable
 knowledge - first.

But there is something in circles.
 Thus O is divided into degrees
 360. of them.

This has nothing to do with the D.S.
 It is a more ancient inheritance than
 that of the D.S.

$$60 \times 6 = 360.$$

60 is an ancient way of dividing O.
 watch-face. - is divided into 60. comes
 fr. v. ancient times - from Egypt
 6. is Central no ^{10x10} instead of 10.
 As in decimal syst. we come to
 6x6. - As it has remained 6 as
 measure included is in this line

These degrees serve for measuring
 angles. In order that circle may
 serve us. ~~Center~~ ^{center} ~~is~~ ^{is} vertex of

angle must be centre. & one pt must be o. & the radius pt where degrees are marked

Measurement of angle are called. we have take on O divided in 360°. So this mat. is also something for measuring angles.

What we may call classical is that its sides are perp.°

Also for angles. -

Made use of O divided up to study 16 angles.

Fraction also

We see that a fraction is a part of the unit Always in realm of fractions till we come to unit - & beyond that in another field - of unities.

If we want to add all these - $\frac{1}{2} \frac{1}{7} - \frac{1}{8}$ I must reduce to one common denominator. $\frac{1}{8}$ ths.

Not only idea of fractions themselves - but of operations in fractions

Also a O. divided in 100. five decimal fractions.

July 15th '29 C. Claremont.

Principle. for Geom. App. serves as a means of Research - v. diff't from doing research yourself.

Not researching for a particular thing.

To discover something one must have an aim. - to work w. some portion of the material in an ~~orderly~~ ^{orderly} way. & there come as by-products. You must have some sort of an aim.

of Chemical Laboratory - not just anyhow work in an orderly way

Example of orderly work.

- 1) Taking out Δ 's & getting similar figures.
- 2) Rectangles & Squares.

This presents you with a new fact.

eg. Take each figure and reproduce it -
cut it out & put on paper.

Large Δ in red: cut into 2. (2 columns)

3 . 4 & so on.

Similarly w. circles.

Later an interest in the angles. -

Child can produce two figures more scientifically. eg. Sq. 10 cm. side - make one

Hook

Indirect Preparations
in Geometry

Definitions

a pt. generates a line
line surface
surf a solid

Line an Abstraction

[Lines n. Metal nuts
and Sockets.]

Parallel Es

From Adv.

40. 3 page m.s.

Articles

Catholic women

Fran O^s Schluter.

Kalbaluk. ?

Montessorian.

Schluter

Reports.

Arrangements.

Job-?

Montessorian Anecdotes.

Anecdotes. -

Children want more accurate instruments
(cf story).

Afterwards child will want to reproduce
Scientifically.

Then comes the question of nomenclature

(a) Name.



(b) Little design to attract attention
to name.

These little designs are really
the old way of doing it.

Typical emotion of discovery is joy &
should accompany to work.

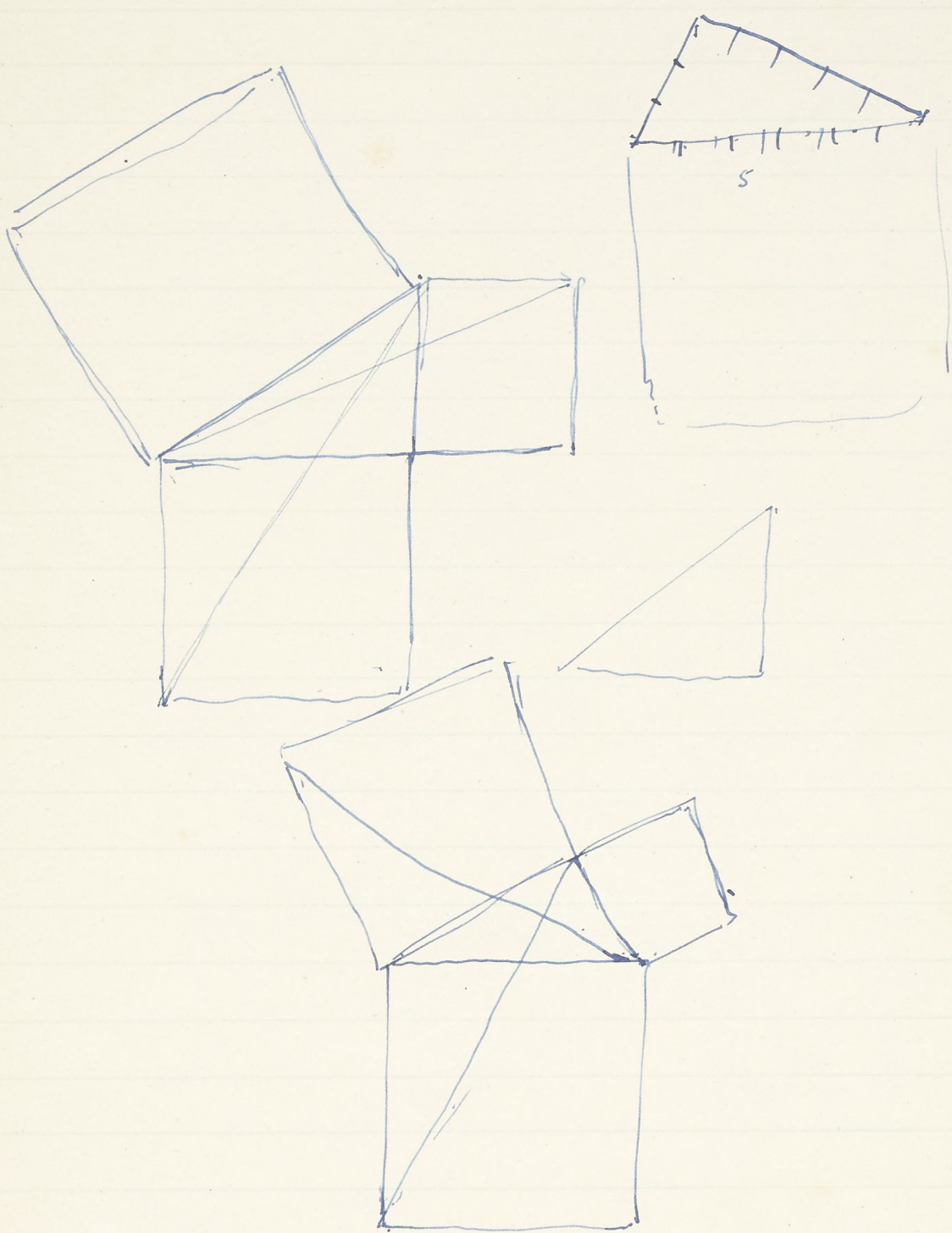
Emotion in text books. The original
discoveries of Scientists accomp^d by joy &
so should be put into text book: as the
child is a discoverer.

Definitions

Child thus definitions of what he
has realized. — so use album for
Gross-Definitions - Introduction first
realization comes first - words
afterwards.

For album contains fig. or facts
defined.

9
16
—
2



Further Steps in Official Geometry.

Chain of import^t facts in every ~~Stage~~ Science
which are the center of them.

Theorem of Pythagoras

So important. - rt. Δ . is basis of
Trigonometry. & Infinitesimal Calculus.

Pathways direct to higher math.

Without Pyth. is no higher math.

Pyth. is a kind of bridge. -

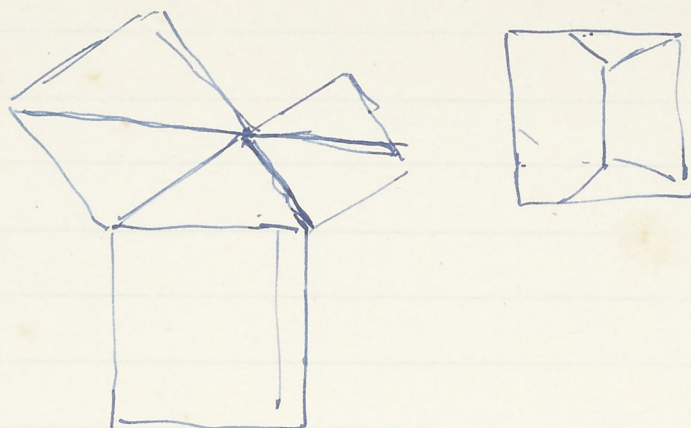
Compares the sides. Sides more import^t
than areas. -

Δ M. shows certain special cases which
exist, as a sort of Vorabkennung of the general
case.

Senses don't supply us with means of
judging area. -

~~more times~~

Quadrilateral particular case: more times
one meets a truth more one can believe
it may be true for all cases.



These problems to do with area suggest eventually the idea of the measurement of area. Can we evaluate a system for measuring area. To measure anything you need a unit, what shall we have as a unit.



If we have circles - not do
squares - also not do.

So we have a difficulty.
The next is a special piece of apparatus to show.

- 1) Area needs a unit
- 2) Can be measure with the unit given.

Beads squares already suggest it with beads covering a surface.

Already child has fresh and the problem

means of measuring area. Actually it
leads to not cover. Area.

Idea of pure number. —

$$\begin{array}{l} 3 \text{ yards.} \\ 5 \text{ yards} \end{array} \quad \frac{3 \begin{array}{|c|} \hline L \\ \hline \end{array}}{5 \begin{array}{|c|} \hline 4 \\ \hline \end{array}} \quad \frac{3}{5} \text{ (pure number)}$$

Also for Teaching Areas. —

By squares & rectangles.

Then we come to a study of the
reduction of difficult figures to more
simple figures