

For a successful CLIL class
a study of math in English session

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basic information

- place: Kokugakuin Univ. Kugayama Junior/Senior High School (Suginamiku, Tokyo)
- frequency: 3 times in one year *special session started Aug, 2015
- teacher: an American professional of math
- text : "THE SHIN-CHU-MON" 7th/8th/9th
- students: from 7th to 11th free to take sessions
- number of participants: av 70-80 max 220
- duration: 2 hours one session or 2 sessions

aim of the session

- short term

math = fun 😊

- long term

- ☆ understand “function” well

- ☆ do math discussion in English

Activate students first !



constructed ground rule

- speak loudly

- make many mistakes

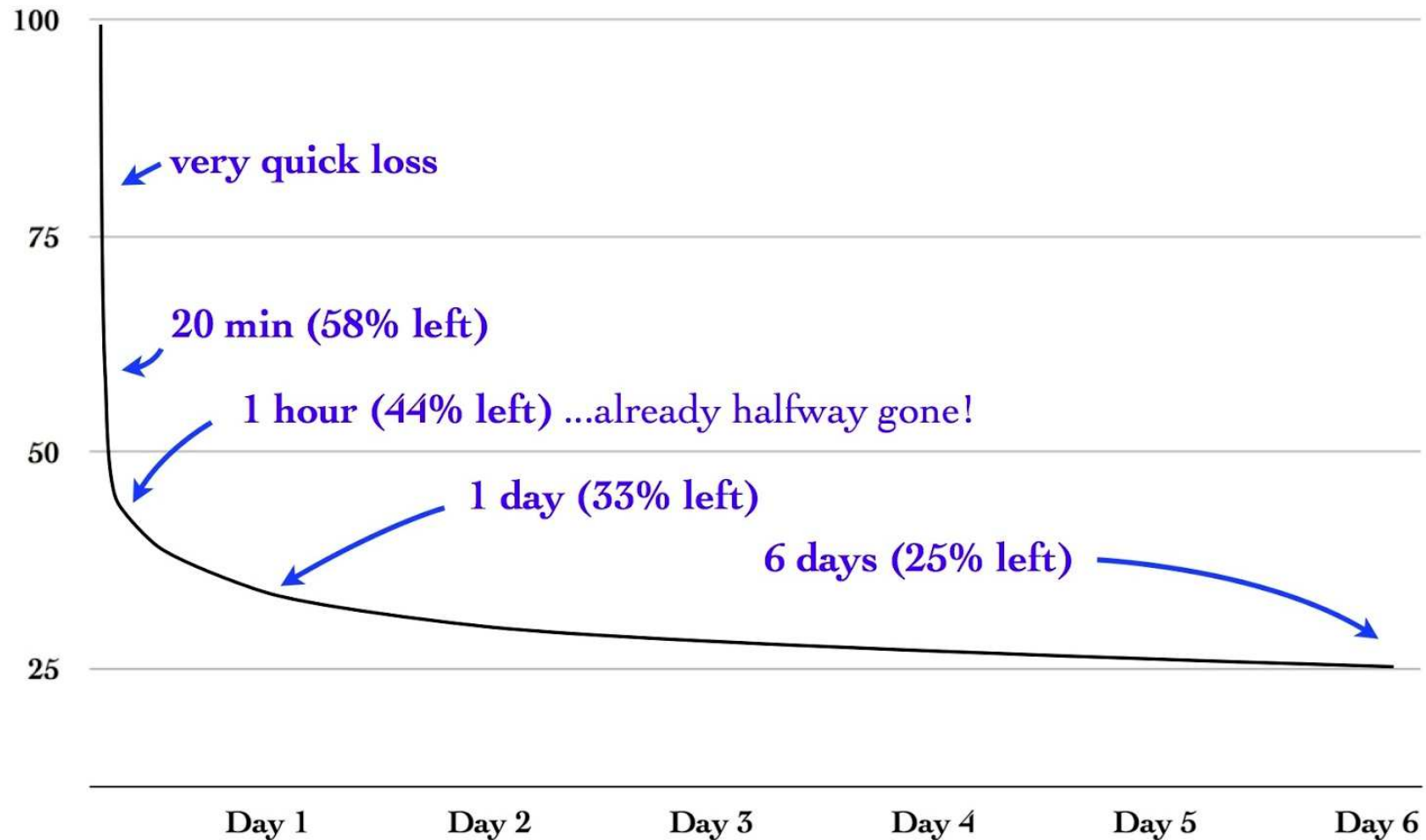
an example of lesson

①LOTS ⇒ ②HOTS

- warm up activity L
- watch lesson video about key topics L
- drill down pair work H
- explain way to solve H
- summary H
- **fill in each reflection sheet H**

Ebbinghaus' Forgetting Curve

(How much of something do we forget each day?)



senseandsensation.com

Why intercultural competence?

- arouse curiosity to language
- notice difference of culture
- lead to motivation to study abroad

How many triangles ?



pair work time

- select any number (any digits)
- add 5
- multiply by 2
- add 4
- divide by 2
- subtract the number at first chosen
- What is the answer?

Signed numbers

Basic calculation with signed numbers

- Sum of two numbers with the same sign
 $(-2) + (-5) = -(2+5) = -7$
- Sum of two numbers with different signs
 $(+3) + (-7) = -(7-3) = -4$
- Subtraction → Add the same number with a different sign
 $(-4) - (-9)$
 $= (-4) + (+9) = +5$
- Product or quotient of two numbers with the same sign
 → Product or quotient of their absolute values with the positive sign
- Product or quotient of two numbers with different signs
 → Product or quotient of their absolute values with the negative sign

Algebraic expressions

How to express products and quotients

- $y \times 8 \times x = 8xy$
 ※ Remove \times symbols. Write numbers in front of letters.
- $a \times a \times a = a^3$
 ※ The product of a letter and itself is written using exponents of powers.
- $(x-y) \div z = \frac{x-y}{z}$
 ※ Write in fraction form without \div symbols.

Calculating linear expressions

- $2x+3+5x-8$
 $= (2+5)x + (3-8) = 7x-5$
- $3(2x+7)$
 $= 3 \times 2x + 3 \times 7 = 6x+21$
- $(15x-9) \div 3$
 $= \frac{15x}{3} - \frac{9}{3} = 5x-3$

Equations

How to solve equations

- $$\begin{array}{lcl} 6x+10-3x-2 & \left. \begin{array}{l} \text{Transpose} \\ 6x-3x=-2-10 \end{array} \right\} & \\ 3x=-12 & \left. \begin{array}{l} \text{Simplify} \\ \text{Divide both sides by} \\ \text{the coefficient of } x \end{array} \right\} & \\ x=-4 & & \end{array}$$

Property of proportional expressions

If $a:b=c:d$, $ad=bc$.

How to solve applied questions of equations

- Let x be an unknown quantity.
- Find an equivalent relationship between two quantities and write an equation.
- Solve the equation to find the

solution.

Proportion and inverse proportion

Proportion $y=ax$

- y is proportional to $x \Rightarrow y=ax$
- If $x \neq 0$, $\frac{y}{x}=a$ (Constant)

Inverse proportion $y=\frac{a}{x}$

- y is inversely proportional to $x \Rightarrow y=\frac{a}{x}$
- $xy=a$ (Constant)

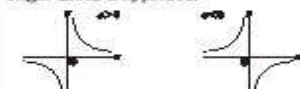
Graph of proportion $y=ax$

Line that passes through the origin



Graph of inverse proportion $y=\frac{a}{x}$

Two curves symmetric about the origin called a hyperbola



Plane figures

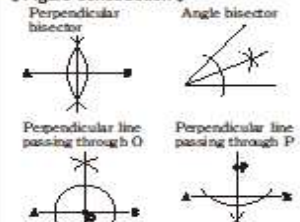
Arcs and chords • Tangents

- Arc: Part of the circumference of a circle
- Chord: Segment linking two points on the circumference of a circle
- A tangent is perpendicular to the radius passing through the tangent point.

Figure Transformation

- Translation: Slide a figure in a single direction for a certain distance.
- Rotation: Turn a figure at a certain angle around a central point.
- Reflection: Turn a figure over a single central line.

Figure construction



Sectors

$$\ell = 2\pi r \times \frac{\theta}{360}, S = \pi r^2 \times \frac{\theta}{360}$$

$$S = \frac{1}{2} \ell r$$

Space figures

Positional relationships between lines and planes

- Between two lines: Intersect, Parallel, In a skewed position
- Between a line and a plane: A line lies on a plane, Intersect, Parallel
- Between two planes: Intersect, Parallel

Volume and surface area of prisms and cylinders

(Volume) = (Bottom area) \times (Height)

(Surface area) = (Lateral area) + (Base area) $\times 2$

Volume and surface area of pyramids and cones

(Volume) = $\frac{1}{3} \times$ (Base area) \times (Height)

(Surface area) = (Lateral area) + (Base area)

Volume and surface area of spheres

$$V = \frac{4}{3} \pi r^3, S = 4\pi r^2$$

Solids of revolution



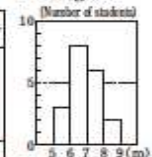
Organizing and making use of data

Organizing data

Frequency distribution table

Class (m)	Frequency
at least less than	
5 ~ 6	3
6 ~ 7	8
7 ~ 8	6
8 ~ 9	2
Total	19

Histogram



(Relative frequency) = $\frac{\text{Frequency of each class}}{\text{Total frequency}}$

Representative values

- How to calculate the mean using a frequency distribution table
 $\rightarrow \frac{\text{Sum of (Class value)} \times (\text{Frequency})}{\text{Total frequency}}$
- Median: Middle value among the values of a data set when they are arranged in size order (Even number of data items \rightarrow Mean of the two middle values)
- Mode: Value that appears most frequently in a set of data

Significant values

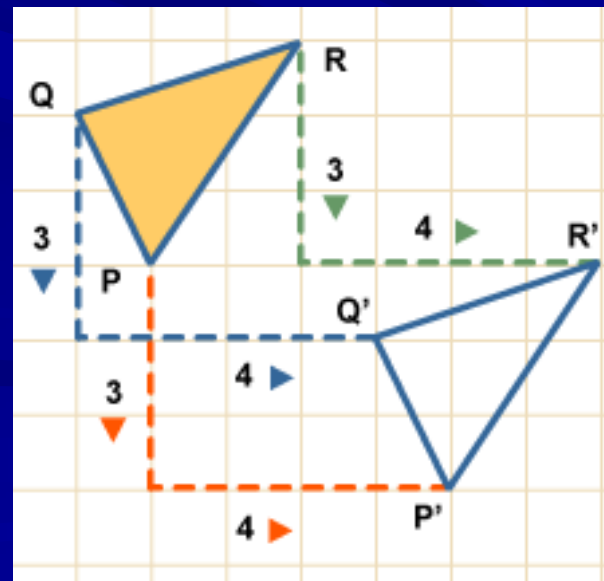
3400 g expressed as a three-digit significant figure is 3.40×10^3 g.

math and English=good match?

- “square” ①shape of a figure
②the second power

- (ex) $3^2=9$

- “translation”



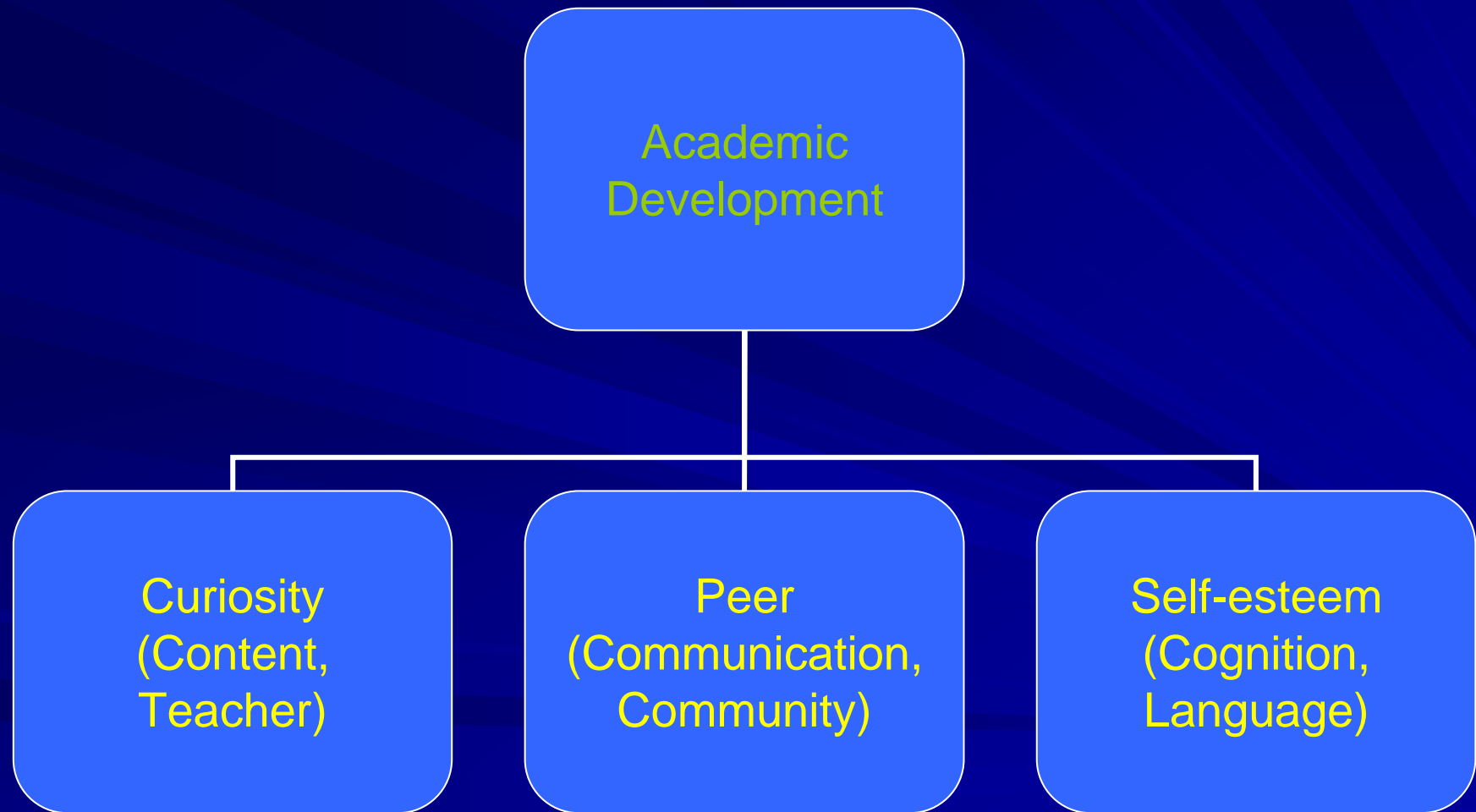
CLIL + active learning = !

- Active lesson is well understandable and it keeps motivation to study at higher level.
= Scaffolding can be implemented automatically.
- What is the elements of an“ active lesson”?
 - * cheerful/bright character of teachers
 - * begin with some warm up tasks
 - * do not be nervous about errors and use many praising phrases
 - * not particular students but almost all can participate in every task
 - * content itself is interesting



Source: National Training Laboratories, Bethel, Maine

a hypothesis



solving a problem of statistics



220students in one session



$$f(n) = n(n+1)/2$$



comment by student (7th grade)

Math in English 第1回振り返り

a 7th grade student's comment

1. Brian 先生のセッションはどのくらい理解できましたか？ (○で囲んでください。)

100% 80% 60% 40% 20% ほとんどわからなかった

2. セッションに参加して良かったことはどのようなことですか？ (日本語で)

基本的な英語で「わり算、かけ算、たし算、ひき算」をなんとい
うのか、というところから、数学の本格的なところまで、幅広く
やってくれて、いろいろ知れたところ。

3. 次回のセッションに対する希望があれば書いてください。 (日本語で)

4. Brian 先生へのメッセージを書いてください。 (英語でも日本語でも OK です。)

数学の授業は、もっと国いものかと思っていましたが、かなり
おもしろい授業で、かなり予想とちがっていました。しかも、このおもしろい
授業のおかげで、数学をおもしろく理解することができました。今日は、ありがとうございました。

comment by student(8th grade)

Math in English 第1回振り返り

student = 8th grade

1. Brian 先生のセッションはどのくらい理解できましたか？ (○で囲んでください。)

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2. セッションに参加して良かったことはどのようなことですか？ (日本語で)

日本語で教えてもらう数学とは違った角度から教えていたとき、とても勉強になった。
私は、最初に Math in English が行われると知った時、日本語でさえ難しい
数学を英語で理解するのは難しいのではないかと考えていたが、自分の想像以上に内容を理解することができた。これからもっと英語を勉強してみたいと思うことができた。

3. 次回のセッションに対する希望があれば書いてください。 (日本語で)

4. Brian 先生へのメッセージを書いてください。 (英語でも日本語でも OK です。)

今回はお急がしい中、私たちのために来て下さり、本当にありがとうございました。
円にうつた点で点でどれだけ線がひけるかということ、何人の人とあく手でできるか
ということがつかないでいて、数学の楽しさや実用性を学ぶことができました。Brian
先生のお話しも本当に分かりやすく楽しかったです。 Thank you very much!!

ratio of fun words

Math in English students` fun words number June 2nd 2016

	participants	fun words	(very fun)	ave/person
7th	44	80	32	1.82
8th	53	53	30	1.00
9th	30	21	7	0.70
10th	27	25	10	0.93
11th	66	63	36	0.95
total	220	242	115	1.10

What will contribute to success?

- strong leadership by the principal
- devotion by Japanese teachers
preparation to implementation
and follow up
- cheerful/bright character of
math teacher

Finally ,

■ 3 questions by Tolstoy

- ① When is the right time?
- ② Who are the right people?
- ③ What is the most important thing?

Thank you