Math activities to increase students' awareness of English and paragraph features

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Problem of students' writing performance

- **"Logic and Expression" in the high school in Japan**
  - ✓students' composition: missing the point, not expressing ideas with appropriate logic (Hisayama, p. 1)

- **Less focus on writing instruction** (Lee & Schallert, 2016; Watanabe & Oba)
  - ✓ developmental-readiness theories → ✘ teaching writing before the attainment of reading ability
  - ✓ more difficult and time-consuming than reading, limited local needs for writing, a lack of teachers' experience, a low level of students' writing experience in their native language

What to learn for writing

- **Before writing**

  learning to organize sentences, paragraphs and ideas coherently (Nugranhini & Rakhmawati 2022)

- **Good organized writing**
  - ✓ structure: clear, concise, focussed, structured and backed up by evidence (Fec, 2019) ---- >> a good paragraph

    --- the roles of sentences, coherence, unity, cohesion (Boardman & Frydenberg, 2008)
  - ✓ types: narrative, descriptive, comparison or cause and effect essays, etc. (Boardman & Frydenberg, 2008)

How to learn the organization of text:

Writing is related to reading.

A good reader is a good writer (Watanabe & Oba, p. 75)

Writing has a similar process to reading (Watanabe & Oba; Lee & Schallert, 2016)

Extensive reading is effective on writing performance in EFL

Researches of writing performance in EFL extensive reading (Nugranhini & Rakhmawati, 2022; Watanabe & Oba, and Lee & Schallert, 2016)

- ✓ organization
- ✓ content
- ✓ vocabulary
- ✓ grammar
- ✓ mechanics
- ✓ overall impression

different genres of English-language books are
- meaningful input
- model of wiriting

How about using math text problems as a reading material?

- ✓ Math text is one of different genres of English language.
- ✓ The content of math text is meaningful.

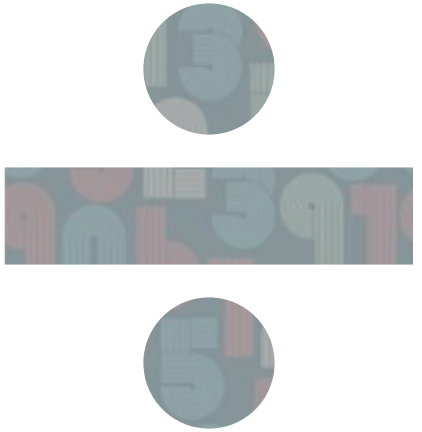
Language is important for math learning (Rinsveld, Schiltz, Brunner, & Lander, 2016)
Thinking ability is influenced by language skills (Mulyati, Damaianti, & Hadianto, 2018)

Reading v. math achievement

- **Reading proficiency is a strong predictor of mathematics achievement** (Salihu, Aro, & Räsänen, 2018)
  - ✓ Difficulties in reading have a negative influence on children's development in general mathematics achievement (Salihu, Aro, & Räsänen, 2018)
  - ✓ Competence of reading and computing competence are two competencies that have a strong relationship (Mulyati, Damaianti, & Hadianto, 2018)
  - ✓ The worse the reading ability of the student is, the worse their performance in mathematics tends to be. ⋯ a low reading score does limit mathematical achievement. (Bohlmann & Pretorius, 2002, p. 201)

  →poor reading ability ----- >>>✘good mathematical performance

- **Obstacles in FL math text** (Novotná, Moraová, & Hofmannová, 2004, p. 3)
  - ✓general vocabulary (e.g., monetarey sysmtem and unit)
  - ✓grammar items
  - ✓mathematical terminology

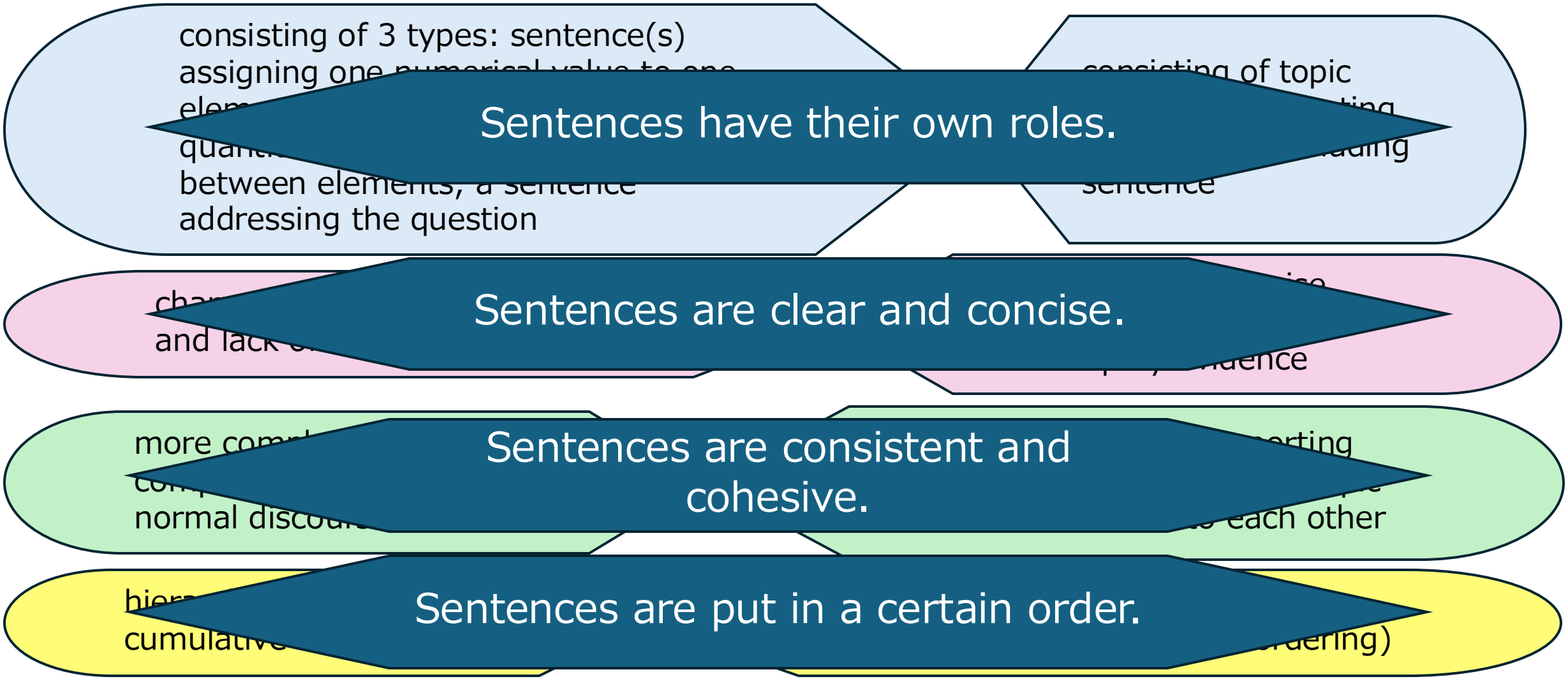


Organization of text problems of math

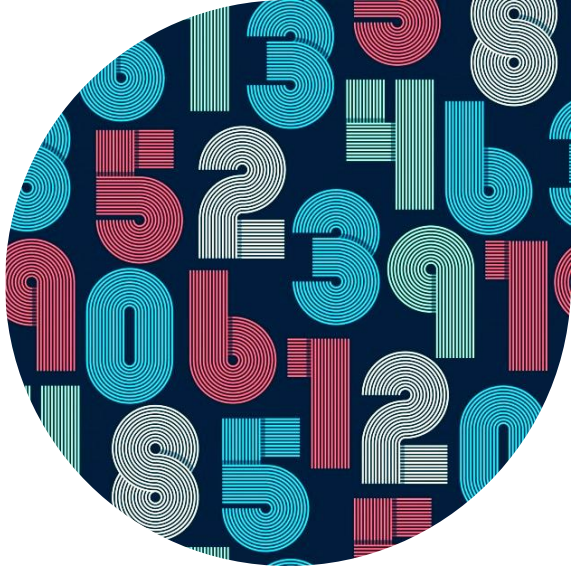
- **features of math text**
  - ✓consisting of 3 types of sentences (Taga):
    - sentences assigning one numerical value to one element
    - sentences expressing quantitative or numerical relationships between elements
    - a sentence addressing the question
  - ✓ more complex and more compact relationships than normal discourse (Crandall, Dale, Rhodes & Spanos 1980).
  - ✓precision, conciseness and lack of ambiguity (Bohlmann & Pretorius, 2002)
  - ✓hierarchical and cumulative (Bohlmann & Pretorius, 2002)
- **requirement of understanding math texts** (Bohlmann & Pretorius, 2002)
  - ✓close attention to detail
  - ✓understanding each statement or proposition for understanding subsequent statements

  →misunderstanding or overlooking → severe consequences for overall comprehension

Is math text a good material for a good model of paragraph reading(writing)?



Research Questions



This study examines

whether math text problems is a good reading material,

in other words, whether it is effective to work on English math text problems in order to make students aware of “paragraph features” in “Logic and Expression”.

1. What are the students aware of in solving English text math problems?
2. Do their comments include phrases related to the paragraph features?

Participants

- 49 3rd-year students (2 classes), in a high school in Tokyo
- 1st and 2nd years: working on paragraph writing and EIKEN writing problems in “English Communication” and “Logic and Expression” classes.
- Their essays contained
  - sentences unrelated to the topic
  - leaps of logic

→difficult for the reader to understand

I agree with the idea that university students should go abroad to study. I have two reasons. First, when they go abroad, they can learn about foreign culture such as movies or music. Music is important because it helps us enjoy life. Second, music encourages people to connect with others. For example, people can make friends by talking about their favorite songs. For these reasons, I think it is necessary for university students to study abroad.

Data collection and analysis

- In “English Communication III” and “Logic and Expression III”
- Activity of English math text problem (1 set) :

  1st to 4th classes --- solving math text problems and writing reflection in the reflection sheets

  5th class --- share their reflections in the class meeting

  4 sets (20 classes)

  Math in Focus (Grade 3, Grade 4)
  Houghton Mifflin School; Student edition
- data analysis: analyzing what the students mention in the reflection sheets qualitatively

Results

rates of correct answers

average: 75.6%

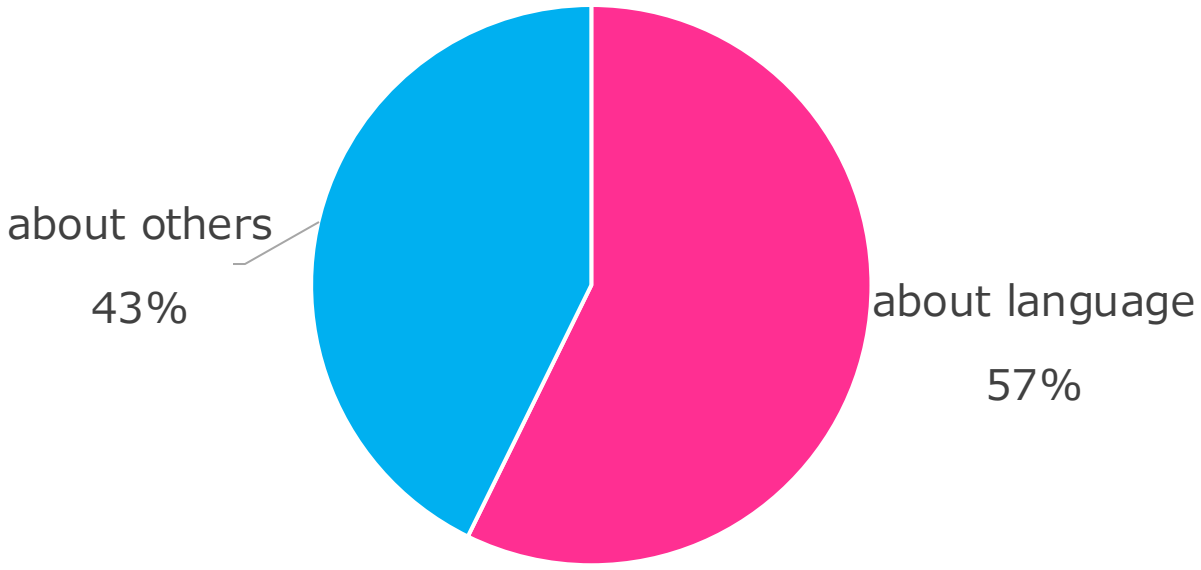
Joycelyn draws and colors some circles on a piece of paper. She colors ⅓ of the circles pink and ⅙ of the circles blue. The remaining 12 circles are colored orange. How many pink circles and blue circles does she draw?

Ms. Patel paid $66 for bread rolls and pies. She bought 8 bread rolls at $3 each. The pies cost $7 each. How many pies did Ms. Patel buy?

no.	number of students	number of correct answers	rate
1	45	24	53%
2	45	34	76%
3	44	33	75%
4	45	41	91%
5	45	29	64%
6	45	21	47%
7	43	36	84%
8	43	39	91%
9	46	38	83%
10	44	41	93%
11	42	32	76%
12	22	13	59%
13	47	37	79%
14	45	40	89%
15	44	35	80%
16	45	32	71%

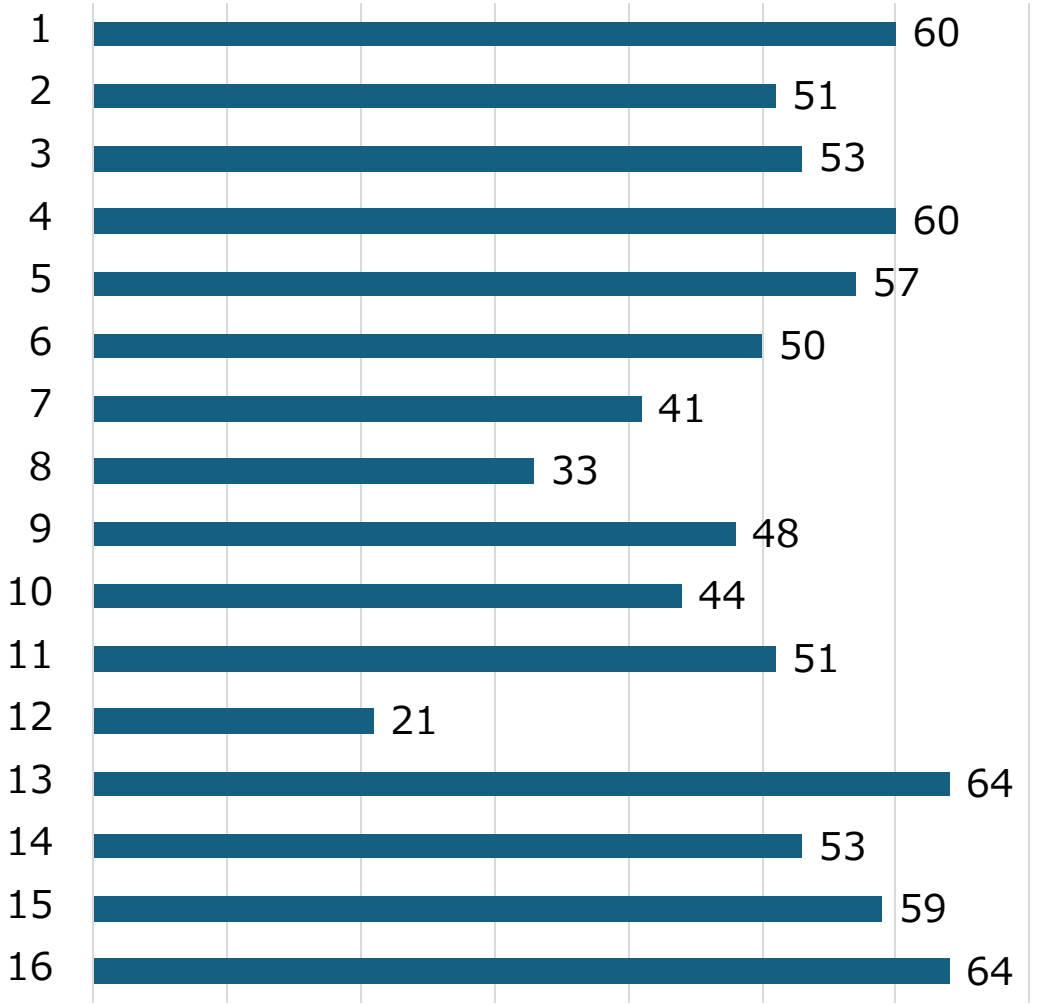
What are the students aware of in solving English math text problems?

contents in the reflection	numbers
about language	461
about others	344
sum	805

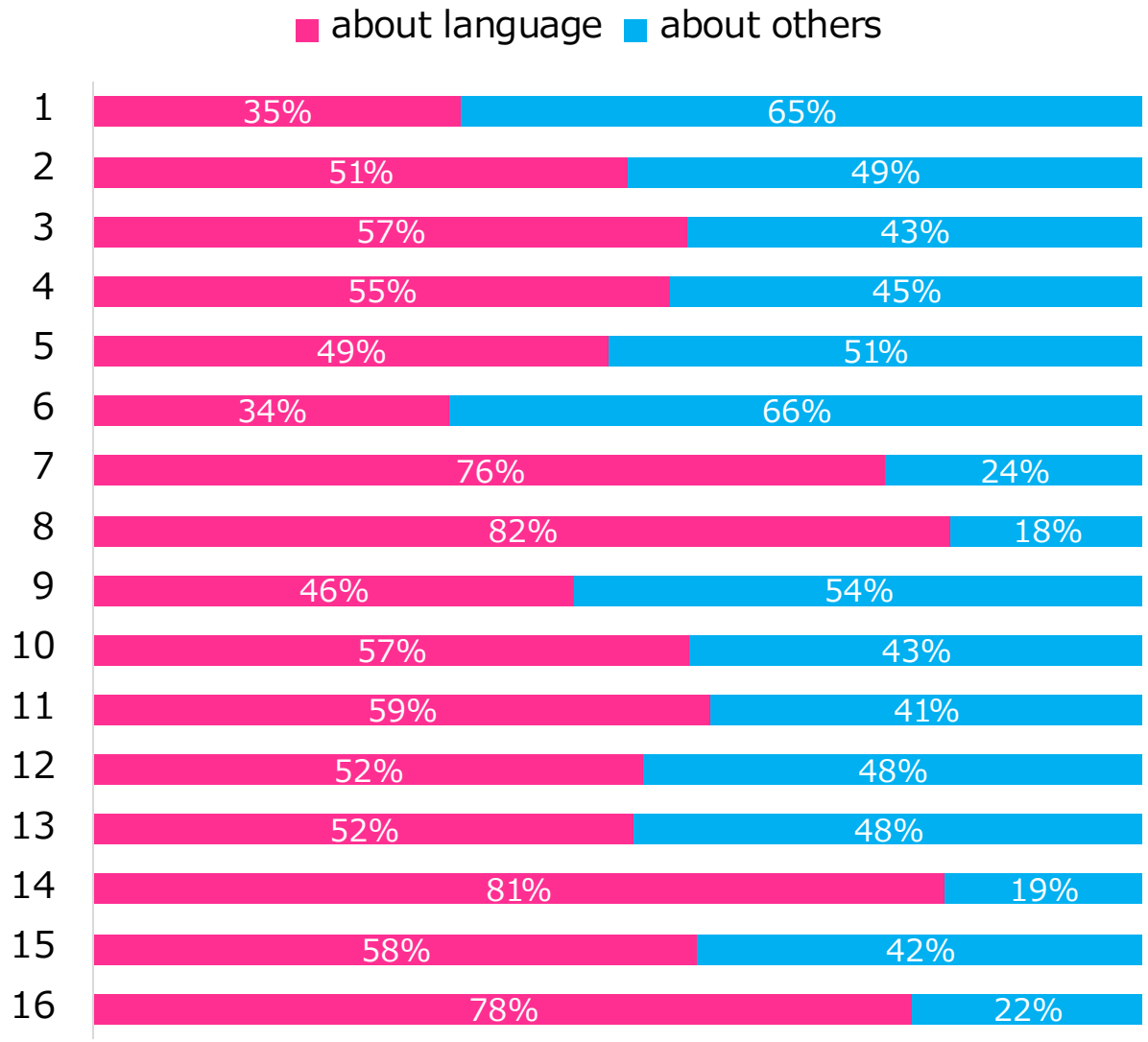


Numbers of contents in each problem

average 50.6



Rates of contents about language and about others in each problem



Co
co
lang

The phrase “$3 each” helped me understand the price of a roll bread.

I understood the situation in which comparative expressions are used.

leave, same, amount of, divide, pa
clip, how many, find, read, can
weighing, ma
color, of
pm., at
piano/pian
soft toy, give, clown, remaining, burst
be to do, seated, first, last, go fo
laps, kil
are
ce

pack, bunch, bundle

When we divide equally, we should use the word “equally” not ”same”

common contents	number	rate
"each"	39	8.5%
comparative expressions	32	6.9%
verb tense	25	5.4%
expressions of quantity	23	5.0%
prepositions	17	3.7%
"another"	15	3.3%
names of persons	13	2.8%
articles	10	2.2%
conjunctions	9	2.0%
"equally"	9	2.0%
plural "s"	6	1.3%
pronouns	6	1.3%
passive	5	1.1%
"There is"	2	0.4%
others	250	54.2%
sum	461	

kilogram, $3.1

about others

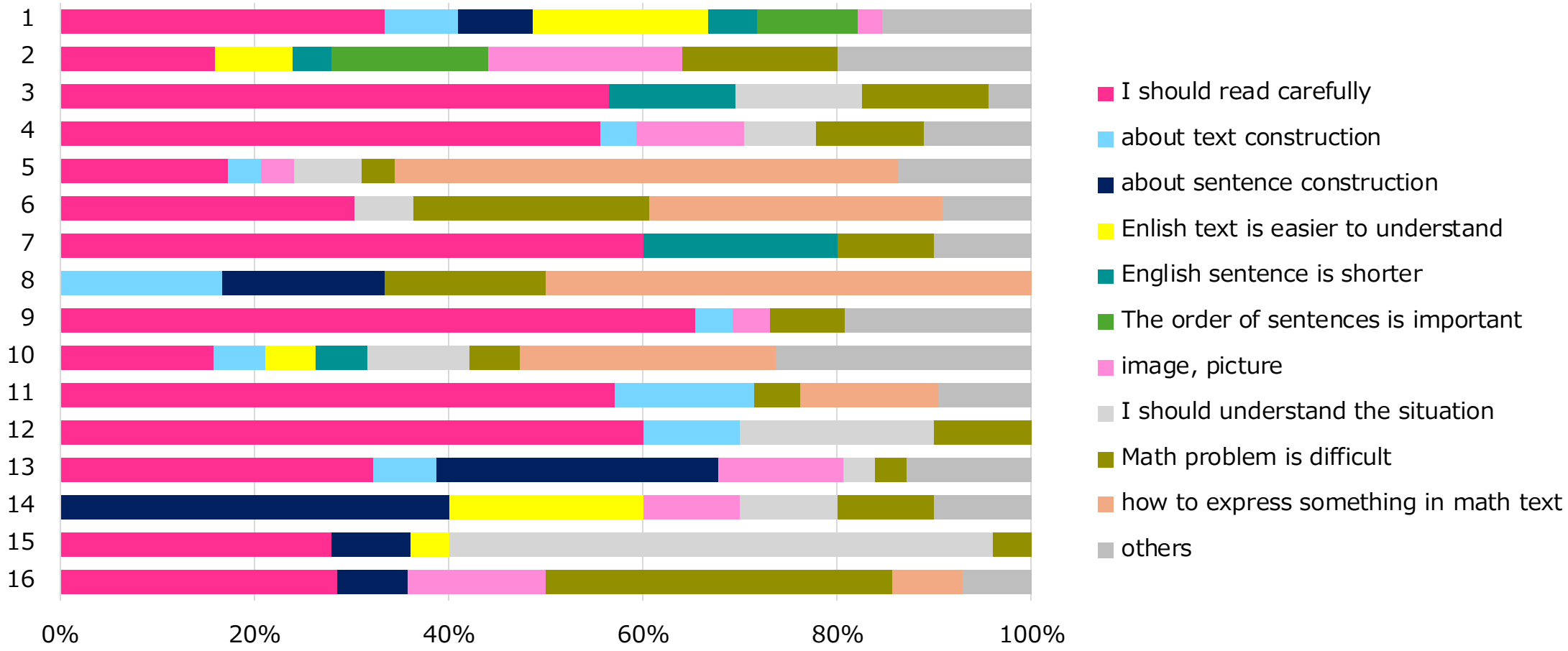
Common contents	number	rate
I should read carefully	125	36.3%
how to express something in math text	37	10.8%
Math text problem is difficult	34	9.9%
I should understand the situation	29	8.4%
image, picture	18	5.2%
about sentence construction	16	4.7%
about text construction		
English math text is easier to understand		
English sentence is shorter		
The order of sentences is important		
others		
sum		

Conditions are followed by detailed explanation.

The students wrote various details in different problems.

The focus is from smaller entities to bigger ones, which enables me to understand the story.

Common contents about others in each problem



Comments including phrases related to the paragraph features?

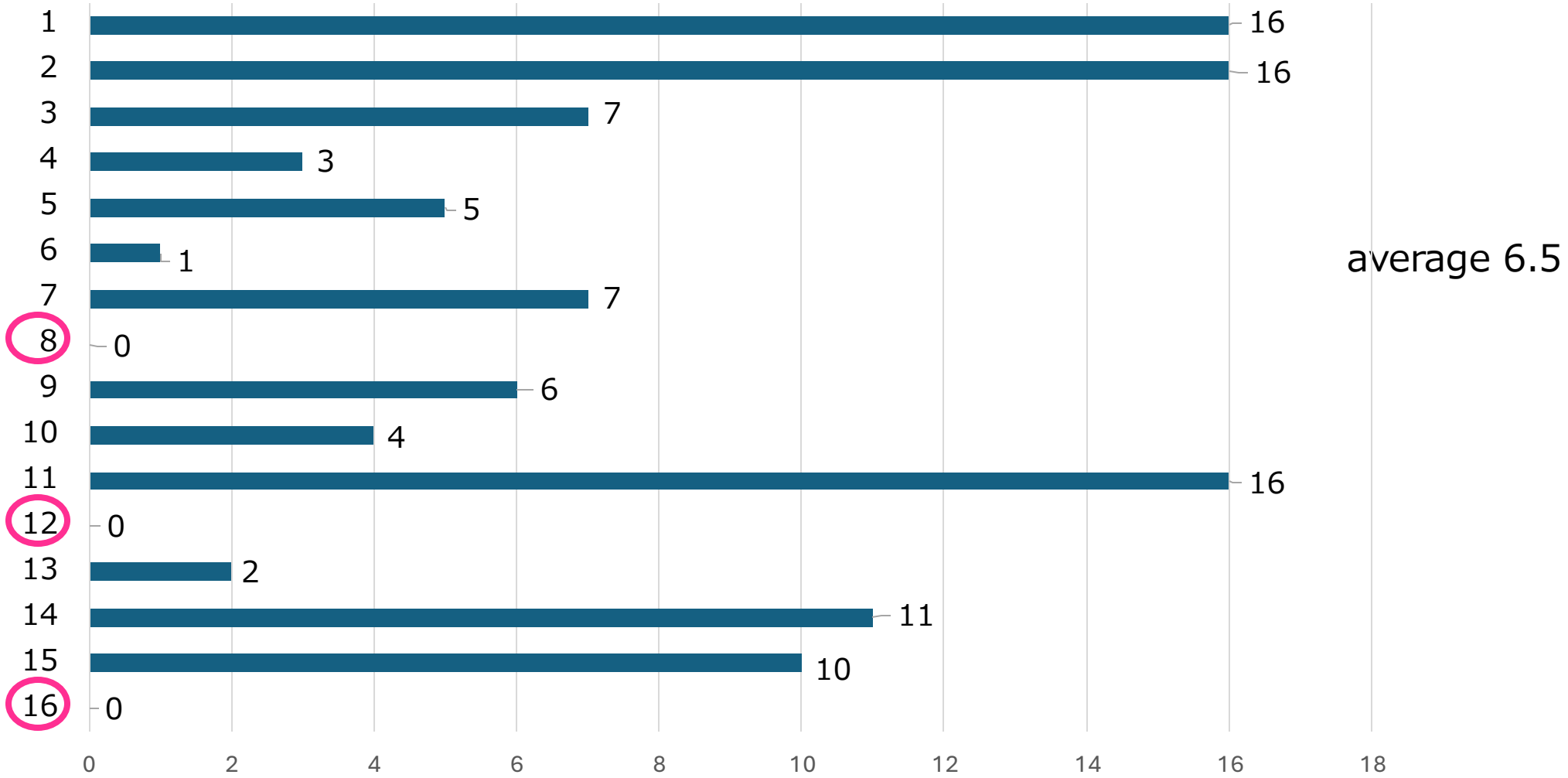
	conte	nber	rate
cohesion		38	36.5%
structured		17	16.3%
not complex and does not require the use of long and complicated vocabulary			15.4%
narrative, descriptive, comparison or ca			
coherence			
unity			.8%
clear, concis			3.8%
focused		3	2.9%
bac		1	1.0%
su		104	

The condition sentence is short, but it makes the situation clearer.

The order of objects is card, then box, which means the order of smaller to bigger. This is the same order to calculate.

I thought that the first line is not necessary, but later I understood the situation better from the first line.

Numbers of comments concerning the paragraph features in each problem



#8

Arianna spent 40 minutes doing her homework. She spent another 45 minutes practicing the piano. She finished her homework and piano practice at 5:30 P.M. At what time did Arianna begin doing her homework?

At what time ~? --- unknown

#12

Avery has 5 bundles of sticks. There are 18 sticks in two such bundles. If she buy[illegible]ne more bundle, how many sticks does she have in all?

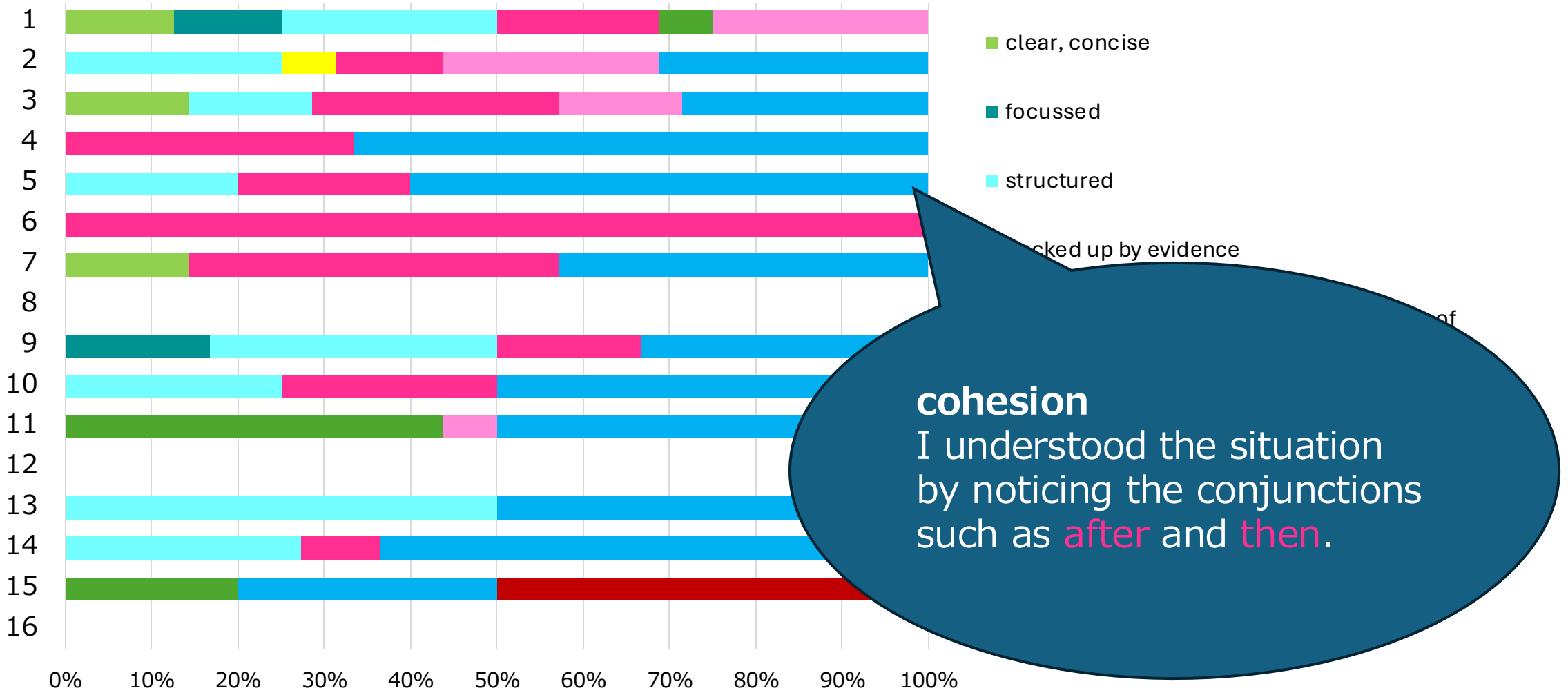
bundle? sticks? --- unknown

math terminology --- unknown

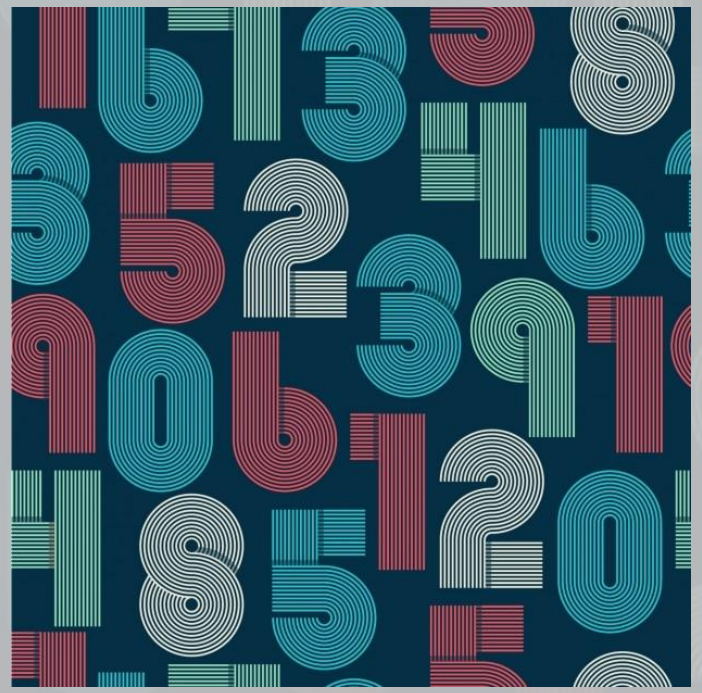
#16

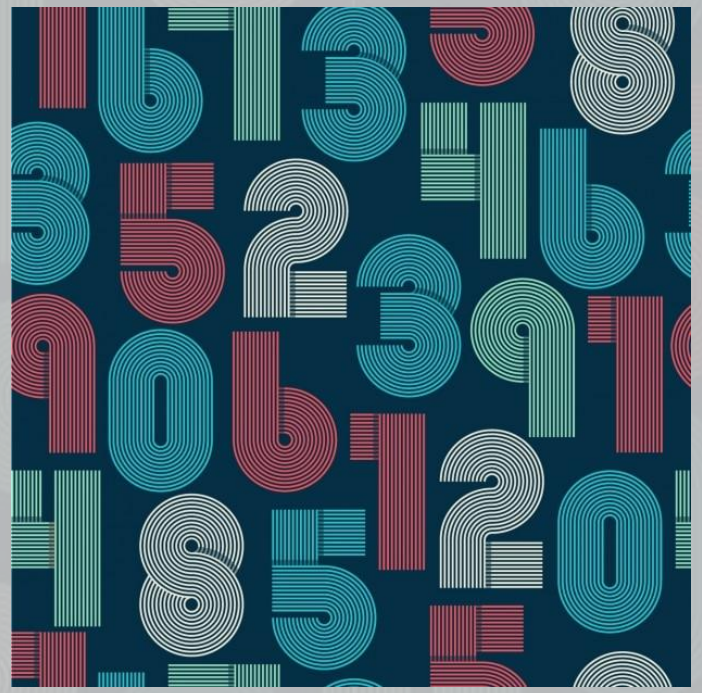
Ms. Adams uses some rectangular cards to make labels for the plants in her garden. Each rectangular card has an area of 32 square centimeters. The length of each of the card is twice its width. What is the length and width of each rectangular card?

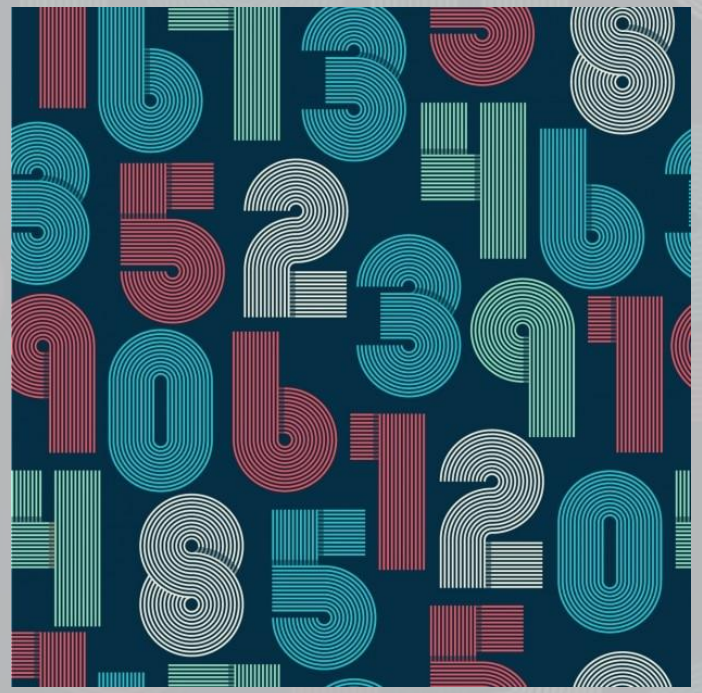
Common contents about the paragraph features in each math text problem



Discussion







RQ 1: What are the students aware of in solving English text math problems?

- **The students' awareness**: about language (57%) about others(43%)
- **The contents about language**
  - ✓ a variety of vocabulary including grammar and math terminology (Novotná, Moraová, & Hofmannová, 2004) :
    - preposition, conjunction, verb tense
    - expressions of quantity: *bundle, pack, bunch*
    - *each*, *remaining*, *another*, equally (appearing frequently and playing important roles in the problems)
- **The contents about others**
  - ✓ The first experience to solve math text problems
    - "I should read carefully." (36.3%)
    - how to express something in math text (10.8%) E: kilograms J:kg
  - ✓ concerning of paragraph features --- not many but
    - text construction (4.1%)
    - "English sentence is shorter." (2.6%)
    - "The order of sentences is important." (2.3%)

RQ 2: Do their comments include phrases related to the paragraph features?

- Yes, a few students' comments which directly described were related to the paragraph features
  - ✓ 104 comments/805 <<< most in the contents about others
  - ✓ Including
    - words/ phrases, such as *clear* and *concise*
    - conjunction of a connector such as *after* and *then*
- Some of the students' comments seemed indirectly related to the paragaraph features (including in the contents about language)
  - ✓ reference to the words such as *another* and *the remaining* --- kind of connectors

→Some students were aware of the paragraph features, while others were not. However, their commnets about language are likely to be related to paragraph features.

I noticed the word, *another*, makes the situation clearer, which means something is added there.

There were 2,800 fruit bars on a shelf at a store. 1,855 of the fruit bars were sold. The store then put up another 738 fruit bars on the shelf. How many fruit bars were on the shelf in the end?

There were 51 children at a party. A clown brought some balloons to the party. He burst 15 balloons and gave the remaining to the children. How many balloons did he bring if each child received 3 balloons?

Once I understood what word *the remaining* referred to, I could solve the problem. So, the remaining is important.

Conclusion

It it possible that to work on English math text problems makes students aware of “paragraph features”.

However, not all the students can be aware of it and it may take time .

It is crucial to read not only narrative stories but also different texts in English in order to be aware of logical constructions of English.

>>> Input is important.

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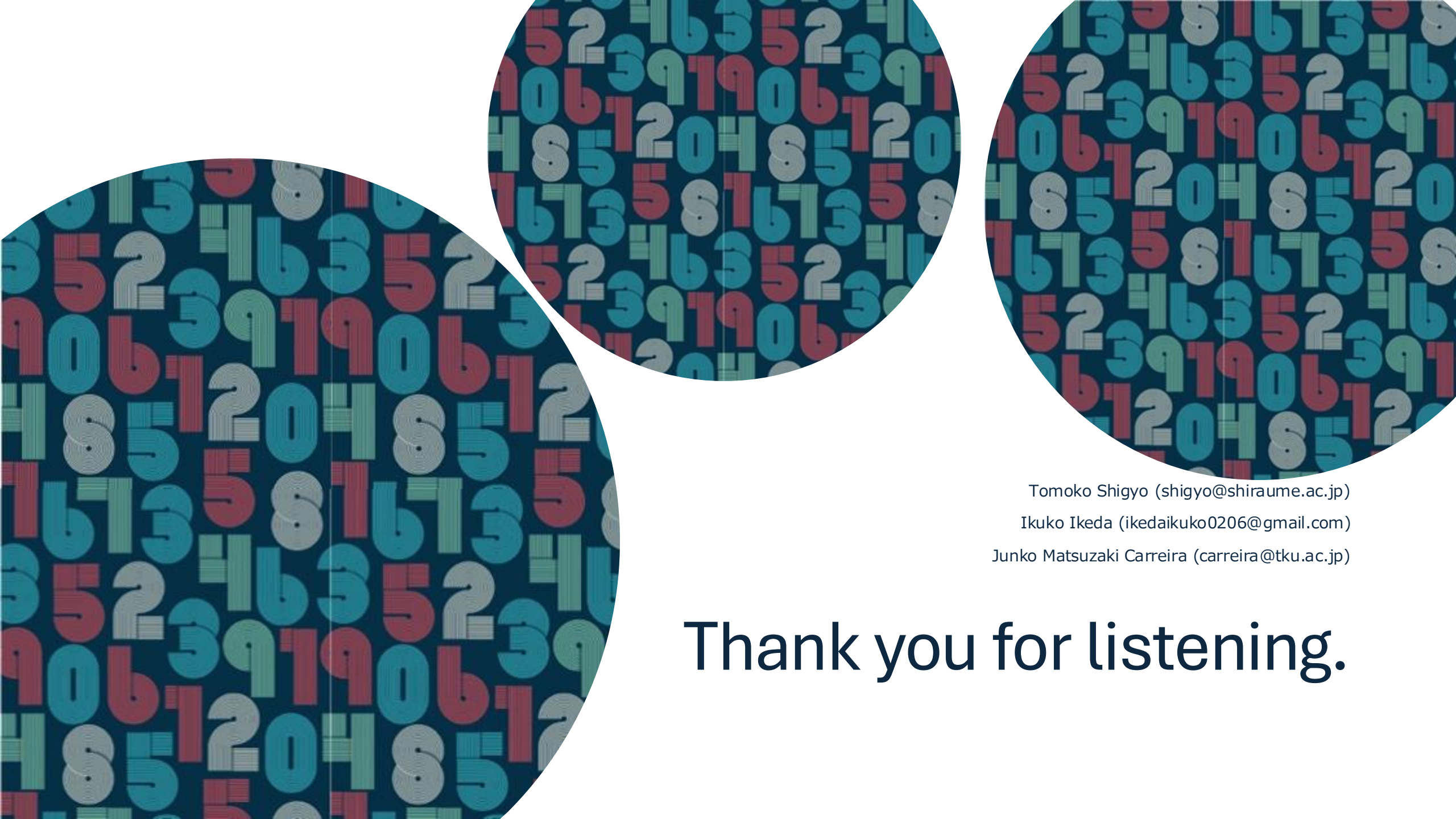
English math text problems

1. There were a total of 406 books in a bookcase. The bookcase had three shelves. The middle shelf held 100 more books than the top shelf. The bottom shelf held 4 times as many books as the top shelf 1) How many books were there on the top shelf? 2) How many books were there on the bottom shelf?
2. Aki has some picture cards. She packed them into packs of 15 cards. Then, she put the packs into boxes of 8 packs. She had 5 boxes of cards. How many picture cards did Aki have?
3. Aubrey and Wyatt saved the same amount of money. Wyatt used $9.14 for a bag and had $16.25 left. Aubrey bought a book from her savings and had $19.51 left. How much did the book cost?
4. Silas and his 3 brothers are at the store. 1) They are buying some pens. Each boy wants 6 pens. How many pens do they need to buy? 2) Silas buys a box of paper clips to divide equally among his 12 friends. There are 120 paper clips in the box. How many paper clips does each friend receive?
5. Three bunches of carrots, A, B, and C, are placed on a weighing scale that reads 3 kilograms 500 grams. After Bunch C is taken off, the scale shows 2 kilograms 800 grams. Then, Bunch B is taken off. The scale shows 1 kilogram 700 grams. Find the mass of each bunch of carrots.
6. Joycelyn draws and colors some circles on a piece of paper. She colors ⅓ of the circles pink and ⅙ of the circles blue. The remaining 12 circles are colored orange. How many pink circles and blue circles does she draw?
7. There were 2,800 fruit bars on a shelf at a store. 1,855 of the fruit bars were sold. The store then put up another 738 fruit bars on the shelf. How many fruit bars were on the shelf in the end?
8. Arianna spent 40 minutes doing her homework. She spent another 45 minutes practicing the piano. She finished her homework and piano practice at 5:30 P.M. At what time did Arianna begin doing her homework?

English math text problems

9. Ms. Watson had 3 boxes of oranges. There were 12 oranges in each box. She shares the oranges equally among herself and her 3 friends. How many oranges did each friend get?
10. Ms. Patel paid $66 for bread rolls and pies. She bought 8 bread rolls at $3 each. The pies cost $7 each. How many pies did Ms. Patel buy?
11. A soft toy animal costs $28.45. It is $15.25 more expensive than a toy robot. A comic book costs $9.21 less than the toy robot. How much does the comic book cost?
12. Avery has 5 bundles of sticks. There are 18 sticks in two such bundles. If she buys one more bundle, how many sticks does she have in all?
13. There were 51 children at a party. A clown brought some balloons to the party. He burst 15 balloons and gave the remaining to the children. How many balloons did he bring if each child received 3 balloons?
14. There are 346 children going for a school trip. All the children are to be seated on 9 buses. On each of the first 8 buses, 40 children are seated. How many children will be seated on the last bus?
15. Mr. Davis and Ms. Johnson practiced running for the 5-kilometer fun run. Each morning, Mr. Davis ran 3 kilometers through the park by the school, while Ms. Johnson ran 7 laps round the school's track. Each lap that Ms. Johnson ran was 400 meters. Who ran a longer distance each morning?
16. Ms. Adams uses some rectangular cards to make labels for the plants in her garden. Each rectangular card has an area of 32 square centimeters. The length of each of the card is twice its width. What is the length and width of each rectangular card?



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Thank you for listening.