

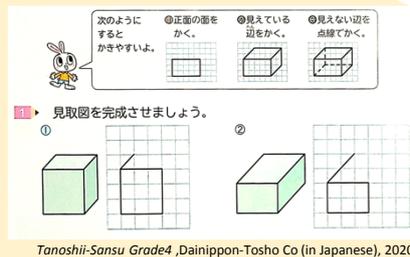
EFFECT OF DRAWING SOLID FIGURES BASED ON PARALLEL PROJECTION

Maiko Sawada
Gunma University, Japan

Hajime Sato
Meiji University, Japan

Background

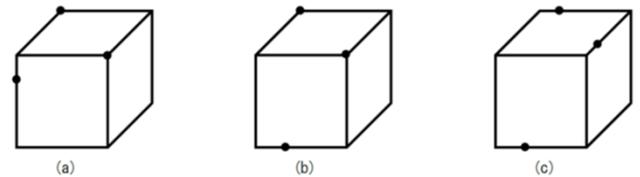
Students learn how to copy and use sketches. Unfortunately they have only few opportunities to learn the geometric relationship between a solid and the figure that represents it.



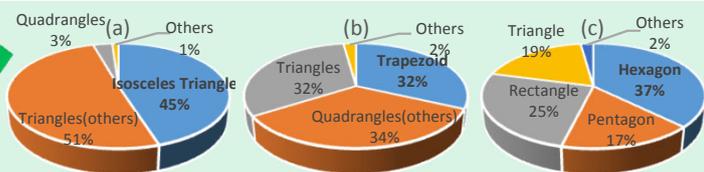
Tanashii-Sansu Grade4 ,Dainippon-Tosho Co (in Japanese), 2020

In Japanese arithmetic classes, by a sketch we mean a figure that allows you to see the overall shape of the solid at a glance, and it is used to solve problems of various spatial figures.

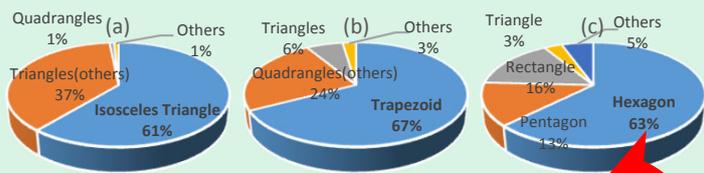
Results of the cut surface problem with a cube sketch



Cut a cube by a plane passing through three points on the edges. Guess the shape of the cutting section. Please answer its name.



University students, Figure A



Junior high school students, Figure A

Drawn Cube Sketches by Students (2017)

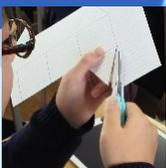
Students	Number	Figure A	Figure B	Others
University students	100	91.0%	7.0%	2.0%
Junior high school students	155	82.6%	14.2%	3.2%
Total	255	85.9%	11.4%	2.7%

Proposal Lesson

Students observe solids from new viewpoints, consider and guess the relationship between the solid and the figures, and repeat the process of drawing figures by parallel projection.

Drawing solid figures based on parallel projection

First, students construct a solid from a geometry net, and then they draw its figures with their own skills.



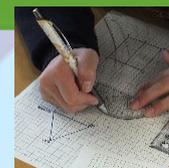
Next, students learn how to draw figures based on orthogonal projection and understand the method of projection.



In the third step, students draw with the auxiliary projection.



Finally, students get the way to draw figures based on oblique projection.



Effect

Students can construct or rotate smoothly the image of solids from the information of their figures.

While drawing figures, students are transforming figures between 3D and 2D with geometric terms (parallel, vertical, angle, triangle, edge, vertex, etc.).

Discussion

- Drawing a copy of figures does not necessarily lead students to recognize figures.
- In the process of drawing figures, it is effective to transform figures between 3D and 2D by using geometric terms.
- Repeating drawing figures under the mathematical rule establishes students' mathematical concept.