

Designing and evaluating experiments: A car ramp Investigation



漢華中學
HON WAH COLLEGE

- Founded in 1945
- A school under the Direct Subsidy Scheme
- A new “through-train” school





Hon Wah College(Primary Section)
Gifted Education

機會 Opportunities



資源 Resources



鼓勵 Encouragement





Three-tier Implementation Model

- Focus on the development of gifted education and the fulfillment of students' multiple intelligences.

Level 3
Off-school support

Exceptionally gifted students are selected to join competitions or enrichment and extension learning conducted by off-site educational organisations/bodies.

Level 2
School-based pull-out programmes

After-school enrichment programmes are organized to nurture gifted students.

Level 1
School-based whole-class teaching

- | | |
|---|---|
| <ul style="list-style-type: none">• Higher-order thinking skills• Brain-based strategies• 5E Inquiry-Based Instructional Model• Cooperative learning | <ul style="list-style-type: none">• Thematic teaching• Cross-curricula project learning activities |
|---|---|

General

Specialised

Background

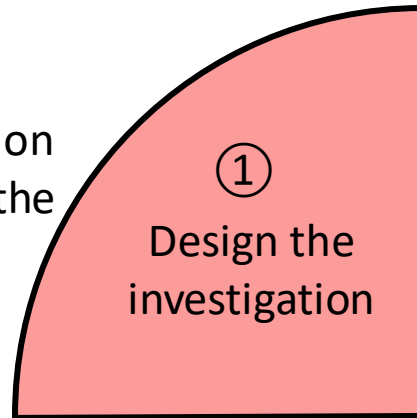
- **Subject:** Science
- **Grade:** Primary 6
- **Chapter:** Force and Motion
- **Learning objective:**

Students will be able to design a fair experiment using a ramp to investigate how surface texture affects friction, by formulating a testable question, identifying variables, and making interpretation based on their findings from the experiment.

Lesson Structure

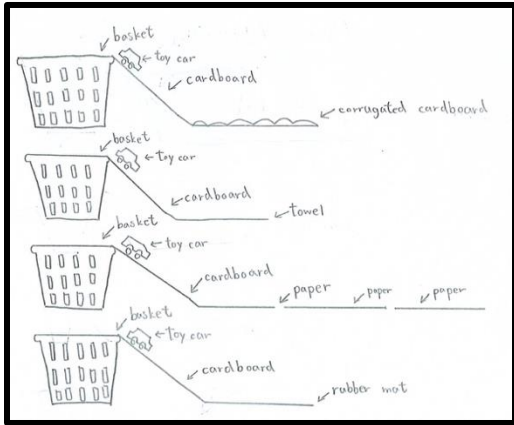
Part 1

Plan an investigation for how far a toy car travels on different surfaces using the materials given.

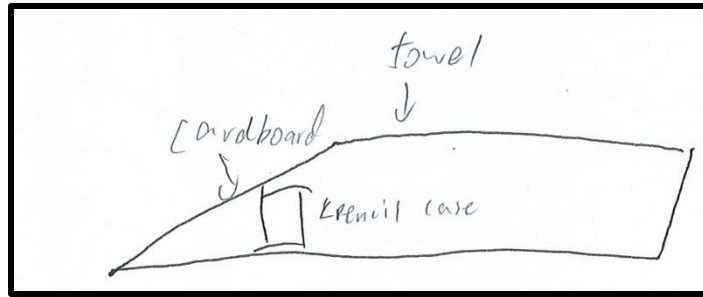


Item	Quantity	Item	Quantity
measuring tape	1	blu tack	some
corrugated cardboard	1	straw	some
paper	3	toy car	1
towel	1	rubber mat	1
basket	1	cardboard	1

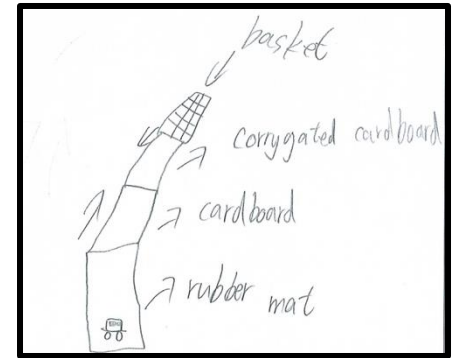
Students' designs



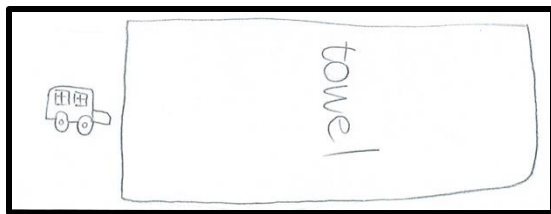
(1)



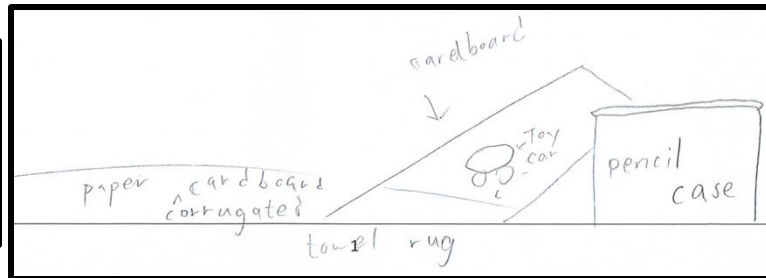
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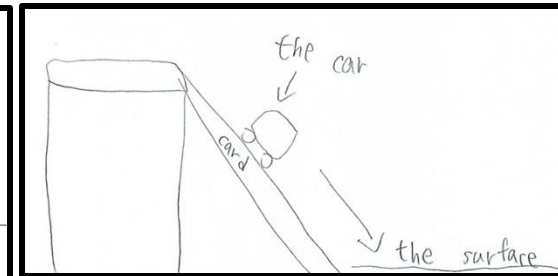
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(4)

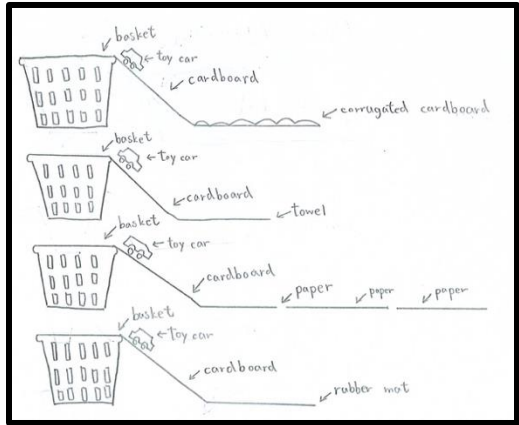
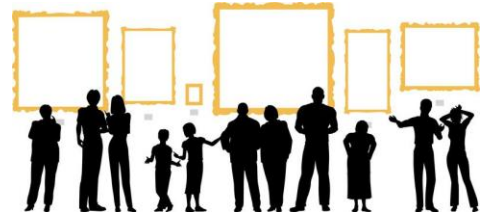


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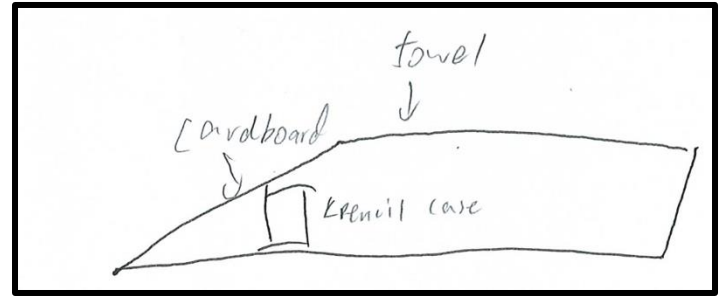


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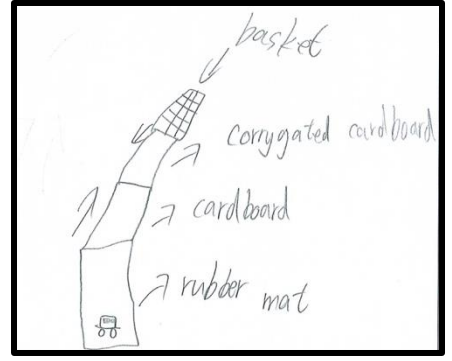
Which design(s) will you choose for whole-class discussion?



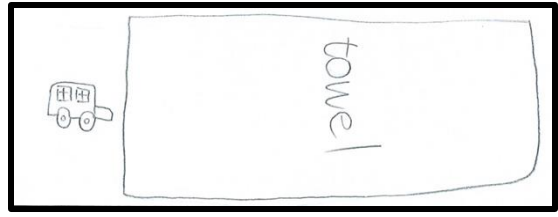
(1)



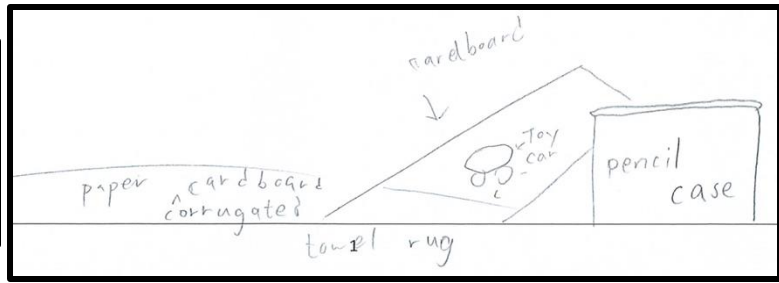
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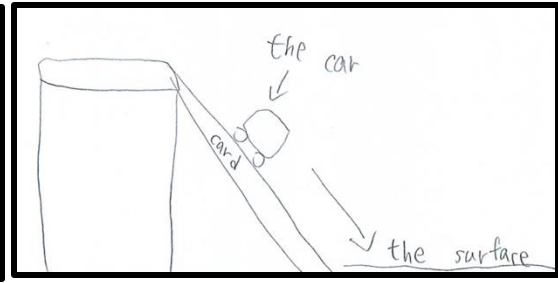
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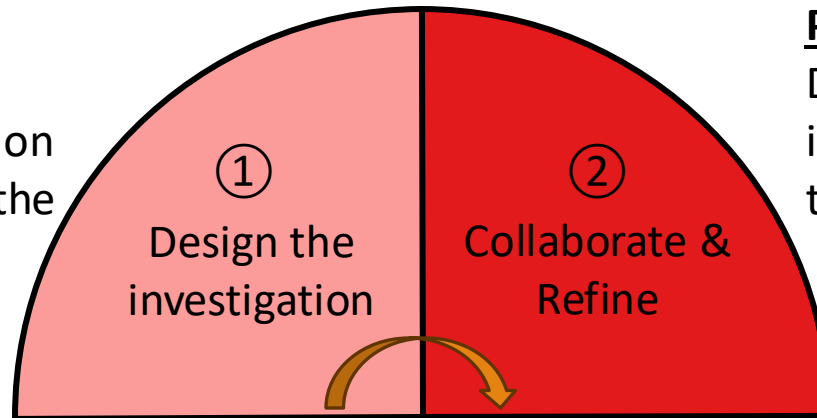


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Lesson Structure

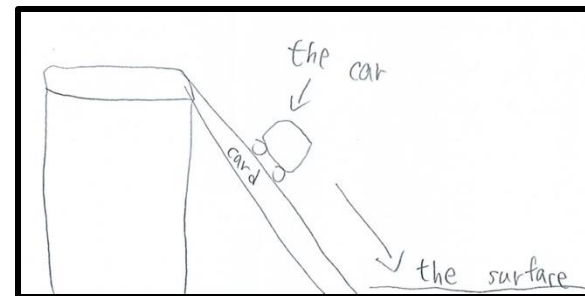
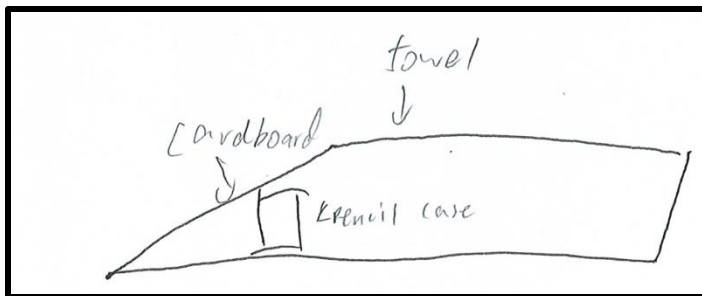
Part 1

Plan an investigation for how far a toy car travels on different surfaces using the materials given.

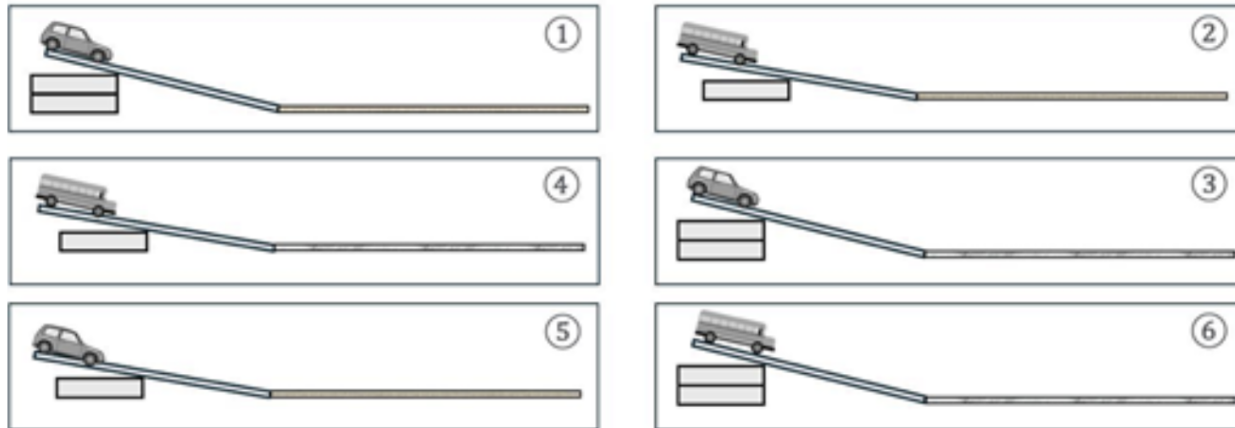


Part 2

Discuss students' ideas, identify variables and make the design better and fair.



Peter, Tom, and Mary are discussing how to design an experiment that compares the distance travelled on different surfaces. Here's what they said:



Peter: "I think Setups 1 and 5 are suitable for this investigation."

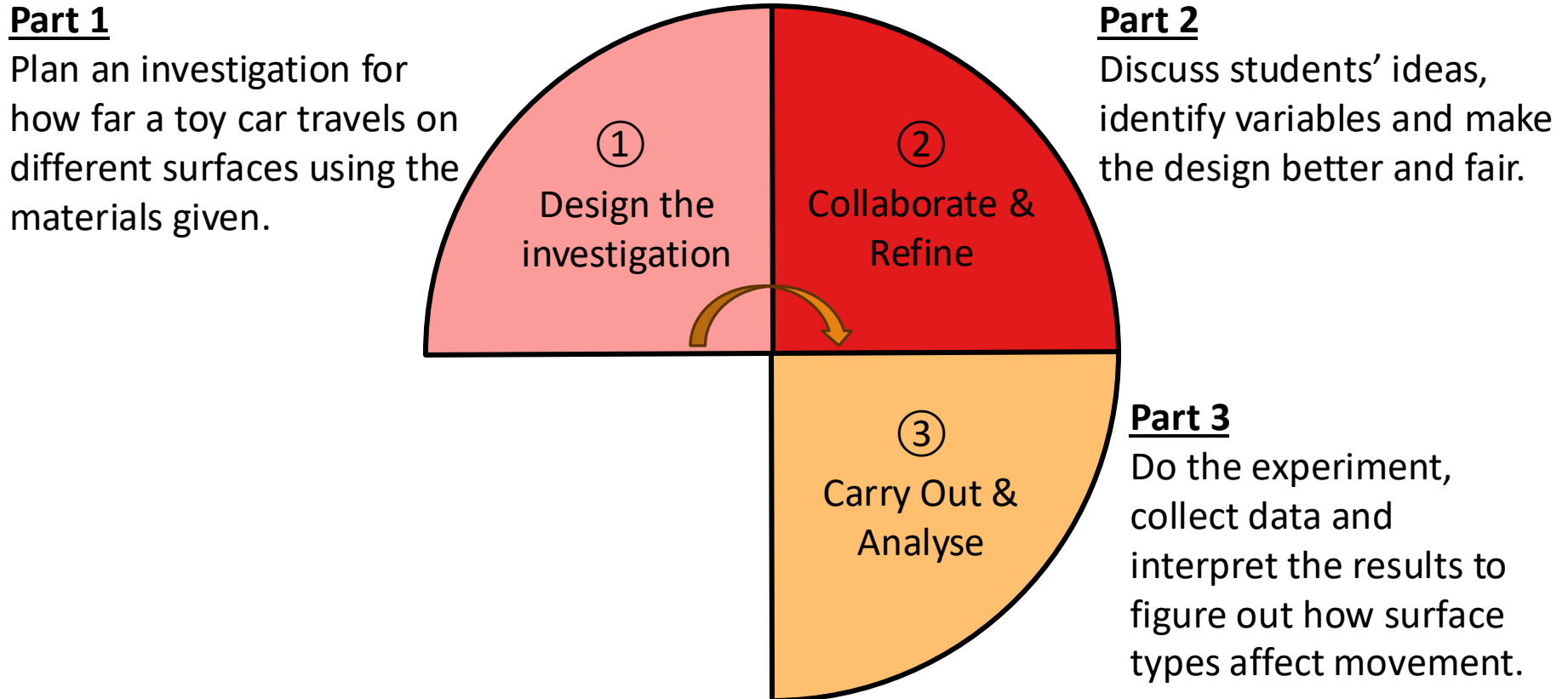
Tom: "I believe Setups 2 and 6 would work well for the investigation."

Mary: "I don't agree with either of you. In my opinion, Setups 2 and 4 are more appropriate for this experiment."

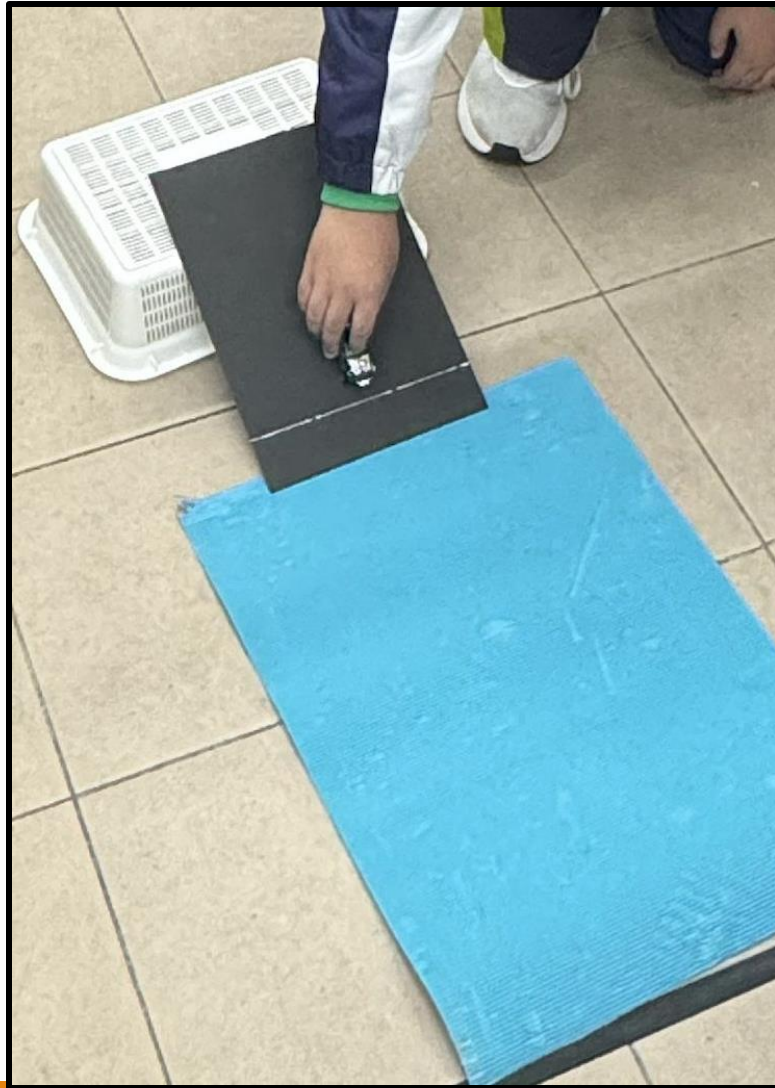
Whose suggestion do you agree with, and why?

Using a concept cartoon for students to evaluate alternative experimental designs, prompting students' reasoning.

Lesson Structure



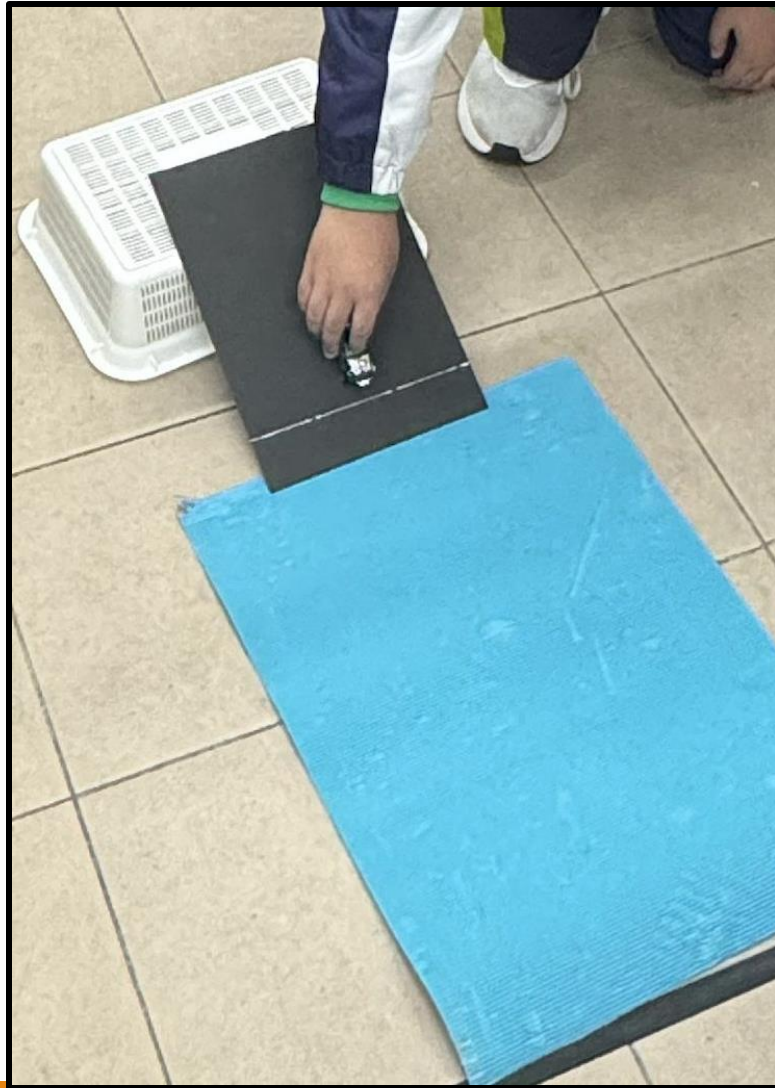
What do you notice?



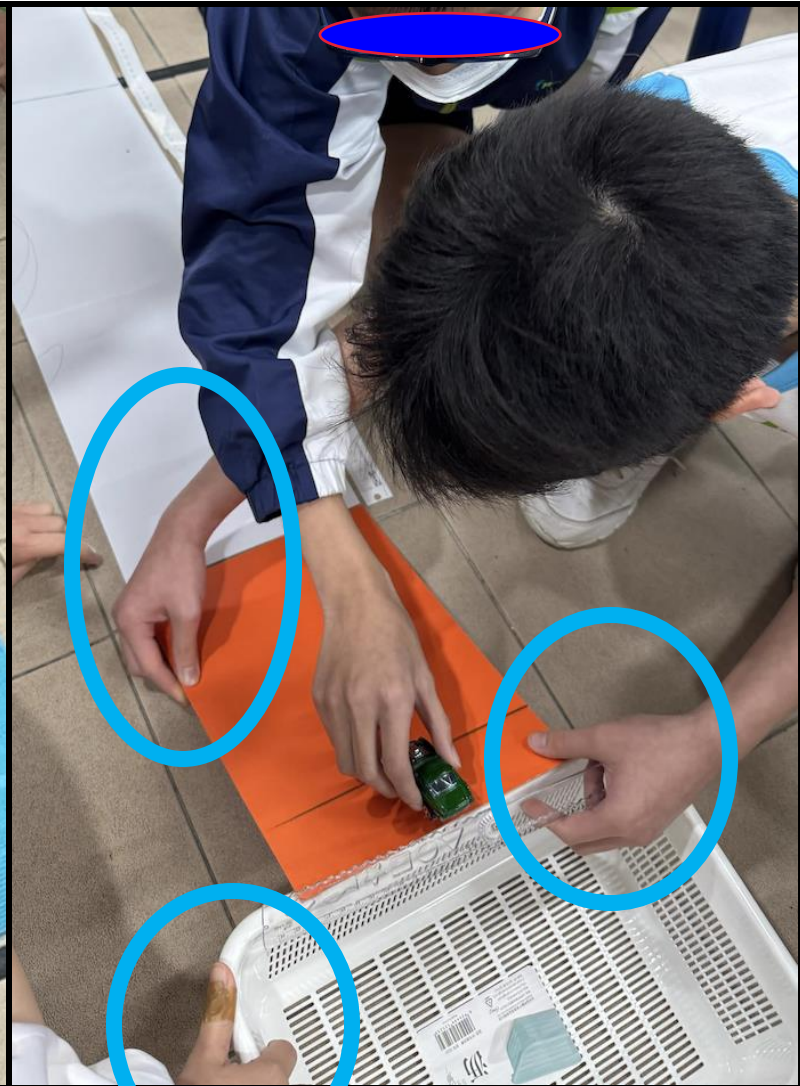
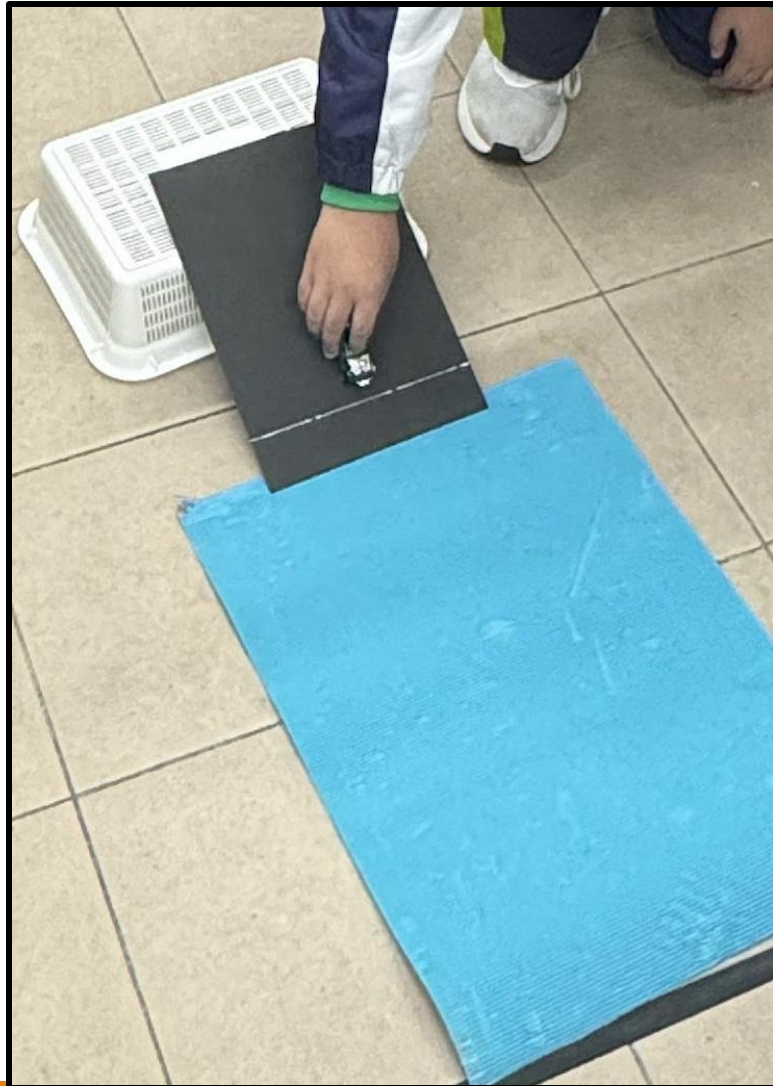
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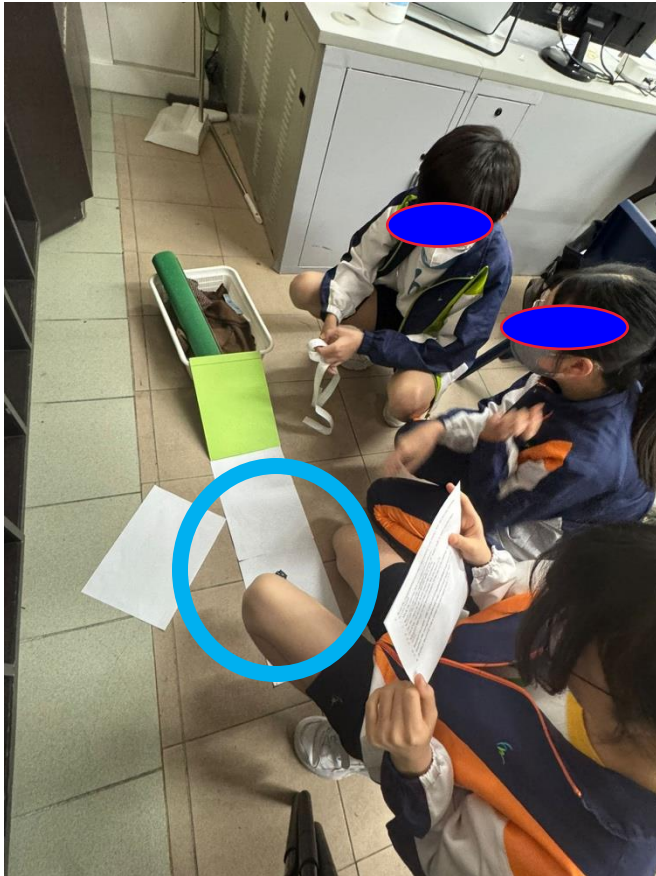
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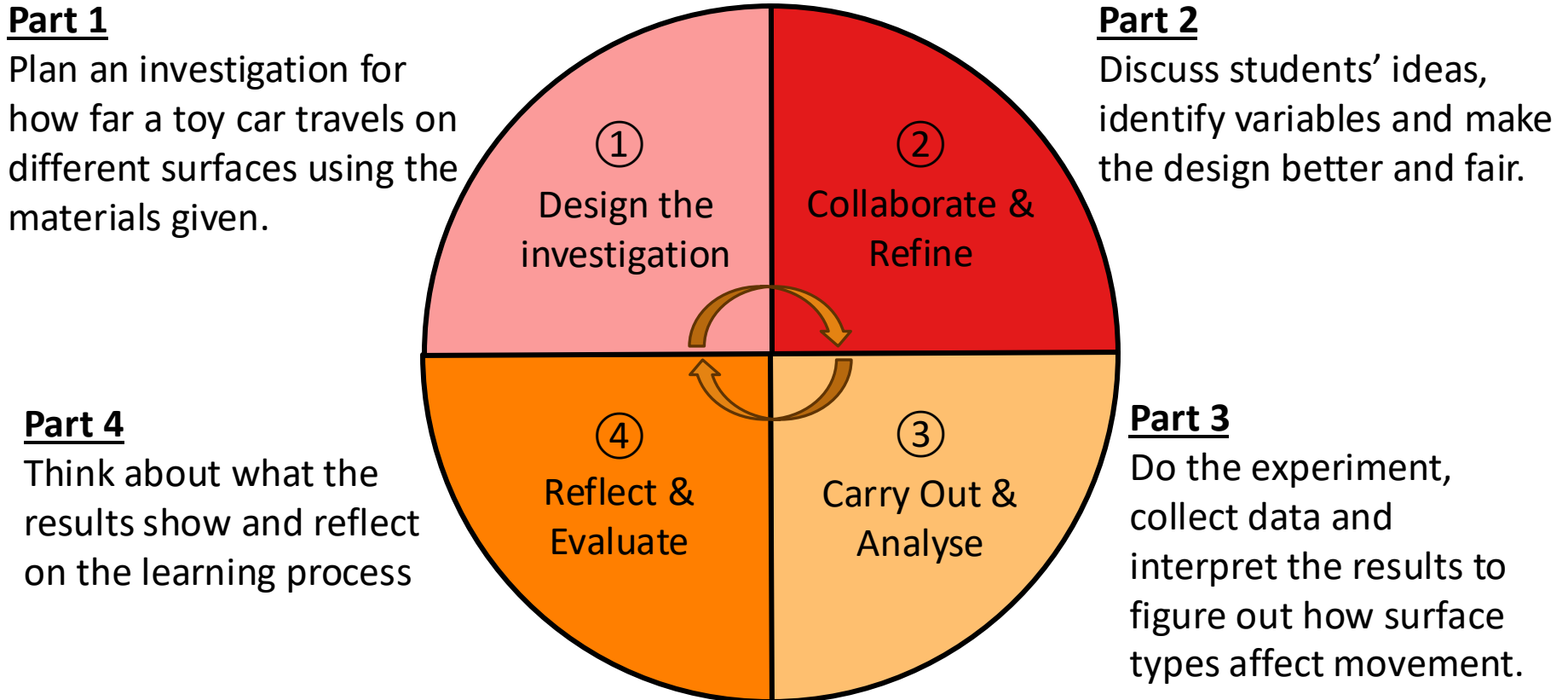
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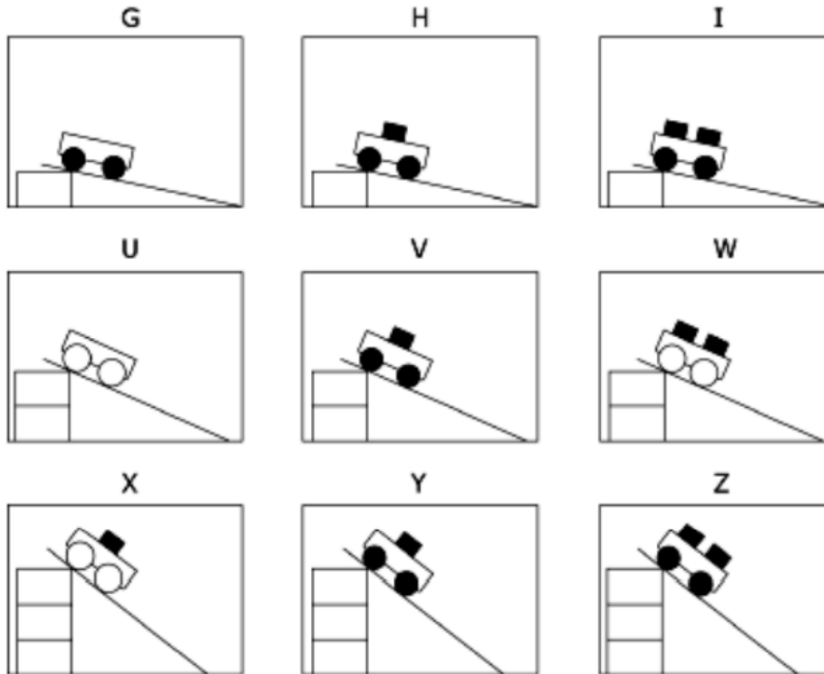


Lesson Structure



Tailored home learning tasks targeting students' different learning domains

The diagrams show different trials Peter carried out with wheels of two different sizes and different numbers of block of equal weight. He used the same ramp for all trails, starting the carts from different heights.



He wants to test this idea: The higher the ramp is placed, the faster the cart will travel at the bottom of the ramp. Which three trials should he compare? Explain your answer.

Focus on SI skills

(Modified from TIMSS 2003 Science)

Tailored home learning tasks targeting students' different learning domains

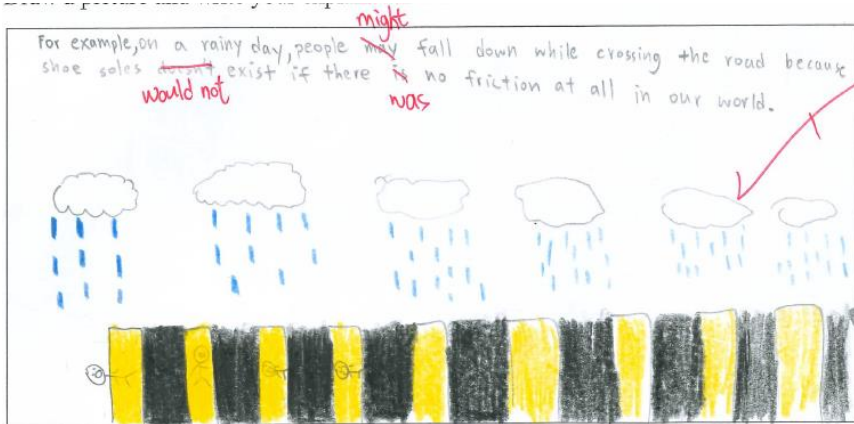
Imagine a World Without Friction

What do you think would happen if there was no friction at all in our world? Draw a picture and write your explanation below.

**Focus on conceptual
understanding & creativity**

Student work

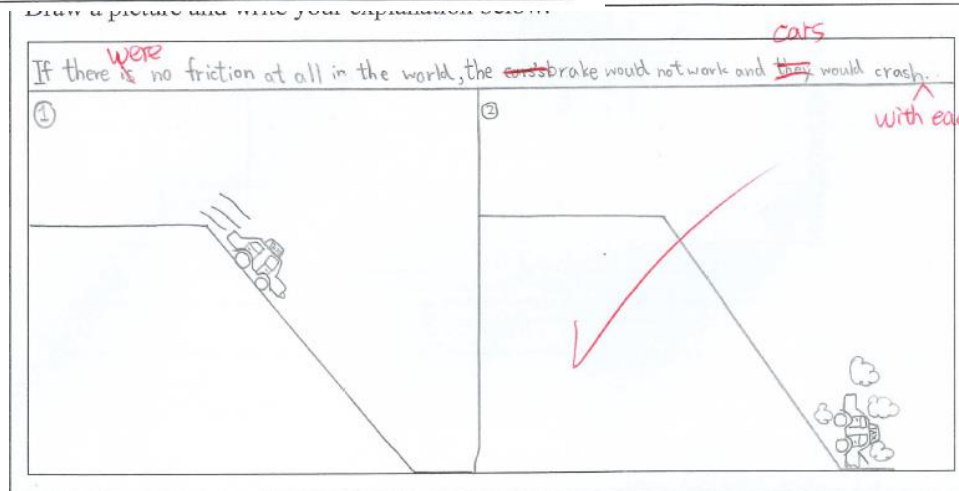
For example, on a rainy day, people ~~may~~ ^{might} fall down while crossing the road because shoe soles ~~don't~~ ^{would not} exist if there ~~is~~ ^{was} no friction at all in our world.



Everyone might slip and get injured. ✓



If there ~~is~~ ^{were} no friction at all in the world, the ~~cars~~ ^{were} brake would not work and ~~they~~ ^{were} would crash ^{cars} with each other.



Conclusion

- **Select students' works strategically:** Choose one clear design and one with gaps for discussion. Prompt students to justify the designs and suggest improvement.
- **Ask intentional questions:** Develop questioning skills to strategically guide students to critique different designs.
- **Observe and guide during experiments:** Notice different implementations and inspire students to assess the feasibility.
- **Design aligned homework:** Design Homework related to the instructional goals and also encourage creativity.