Red-hot Racers

by Maggie Lilleby

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Overview

Miniature dragsters were the focus of a technology challenge for a group of intermediate students. In this article, we follow the planning, construction, and testing of the students' designs. It is all about speed. Readers will learn about the different factors students had to consider when designing and making aerodynamic cars. The physics concepts and scientific language are supported by the text, and additional information comes from photographs, text boxes, diagrams, and a table. Students will need to use their knowledge of non-continuous text structures to support their understanding of the text.

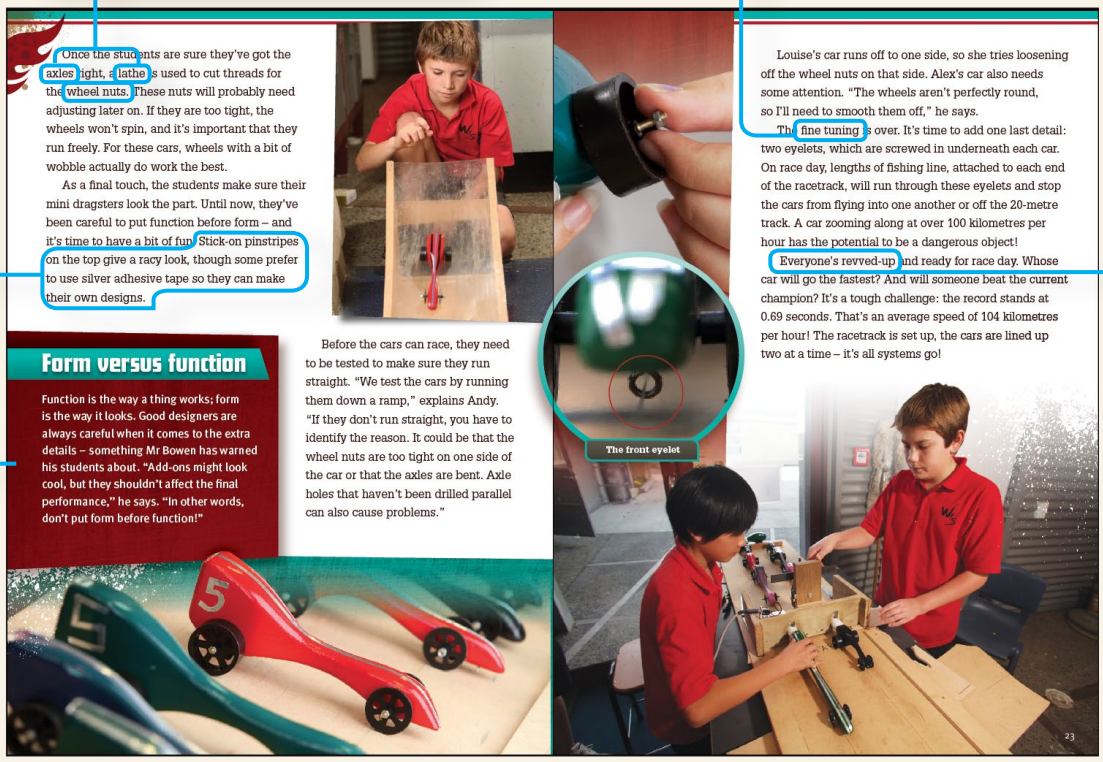
Texts related by theme **"Bottles into Rockets!"** SJ 3.2.03 | **"Patu Mania"** SJ 4.2.08

Text characteristics from the year 8 reading standard

sentences that vary in length, including long, complex sentences that contain a lot of information

words and phrases with multiple meanings that require students to know and use effective word-solving strategies to retain their focus on meaning

academic and content-specific vocabulary



Once the students are sure they've got the axles right, a lathe is used to cut threads for the wheel nuts. These nuts will probably need adjusting later on. If they are too tight, the wheels won't spin, and it's important that they run freely. For these cars, wheels with a bit of wobble actually do work the best.

As a final touch, the students make sure their mini dragsters look the part. Until now, they've been careful to put function before form – and it's time to have a bit of fun. Stick-on pinstripes on the top give a racy look, though some prefer to use silver adhesive tape so they can make their own designs.

Form versus function

Function is the way a thing works; form is the way it looks. Good designers are always careful when it comes to the extra details – something Mr Bowen has warned his students about. "Add-ons might look cool, but they shouldn't affect the final performance," he says. "In other words, don't put form before function!"

Before the cars can race, they need to be tested to make sure they run straight. "We test the cars by running them down a ramp," explains Andy. "If they don't run straight, you have to identify the reason. It could be that the wheel nuts are too tight on one side of the car or that the axles are bent. Axle holes that haven't been drilled parallel can also cause problems."

Louise's car runs off to one side, so she tries loosening off the wheel nuts on that side. Alex's car also needs some attention. "The wheels aren't perfectly round, so I'll need to smooth them off," he says.

The fine tuning is over. It's time to add one last detail: two eyelets, which are screwed in underneath each car. On race day, lengths of fishing line, attached to each end of the racetrack, will run through these eyelets and stop the cars from flying into one another or off the 20-metre track. A car zooming along at over 100 kilometres per hour has the potential to be a dangerous object!

Everyone's revved-up and ready for race day. Whose car will go the fastest? And will someone beat the current champion? It's a tough challenge: the record stands at 0.69 seconds. That's an average speed of 104 kilometres per hour! The racetrack is set up, the cars are lined up two at a time – it's all systems go!

The front eyelet

illustrations, photographs, text boxes, diagrams, maps, charts, and graphs, containing main ideas that relate to the text's content

metaphor, analogy, and connotative language that is open to interpretation

Reading standard: by the end of year 8

Possible curriculum contexts

SCIENCE (Physical World)

LEVEL 4 – Physical inquiry and physics concepts: Explore, describe, and represent patterns and trends for everyday examples of physical phenomena ...

ENGLISH (Reading)

LEVEL 4 – Structure: Show an increasing understanding of text structures.

ENGLISH (Writing)

LEVEL 4 – Structure: Organise texts, using a range of appropriate structures.

Possible reading purposes

- To find out about miniature dragsters
- To identify the factors that make a dragster aerodynamic
- To understand the scientific concept of aerodynamics
- To explore methods of presenting information.

See Instructional focus – Reading for illustrations of some of these reading purposes.

Possible writing purposes

- To describe the process of making something
- To persuade your technology teacher that you should make miniature dragsters and why
- To compare the aerodynamic qualities needed for different types of racing cars.

See Instructional focus – Writing for illustrations of some of these writing purposes.

The New Zealand Curriculum

Text and language challenges

VOCABULARY:

- Possible unfamiliar and/or specialist words and phrases, including "absorbed", "miniature", "sleek", "canister", "primed to perfection", "pitted", "dragster", "design", "balsa", "aerodynamic", "surface contact", "friction", "withstand", "pressures", "force", "generated", "thrust", "drag", "disturbance", "airflow", "succumb", "spoiler", "variables", "flared", "streamlined", "bandsaw", "rasp", "brass", "rods", "axles", "lathe", "wheel nuts", "function before form", "adhesive", "performance", "parallel", "eyelets", "reigning", "compressed", "pressurised", "propels", "mechanism", "pierced"
- Collocations – "red-hot", "carbon dioxide", "fine tuning", "wind drag"
- Colloquial and idiomatic language, including "pitted against each other", "really can motor", "rocket along", "a long way down the track", "gruntier", "ins and outs", "a final touch", "racy", "add-ons", "zooming along", "revved-up", "it's all systems go".

Possible supporting strategies

Identify new vocabulary that the students should prioritise for learning. *The English Language Learning Progressions: Introduction*, pages 39–46, has useful information about learning vocabulary.

Before reading, give each pair a poster with some of the illustrations in the middle and ask them to brainstorm and write any associated words or phrases they think of (including in languages other than English). Set a time to do this, and then ask the pairs to pass their poster to another pair. Have the pairs discuss what's on the poster and add their ideas. Continue until each pair has written on each poster. Display and discuss the posters.

Select vocabulary the students need to know to understand the text and that they should focus on learning. Prepare definitions (using pictures and words). Before reading, give each pair some words and definitions to be matched. Tell them these words are in the text. Have them look at the pictures (and at the posters if you have done this activity) and match their words and definitions. Tell them to make three to five predictions about the content of the text based on their words. Have all pairs share their words, definitions, and predictions (confirm the correct matches as they do so). Record the predictions and refer back to them (as well as the definitions) during reading. After reading, provide opportunities for students to practise using the new vocabulary. Over time, ensure they encounter and use the language in a range of contexts.

SPECIFIC KNOWLEDGE REQUIRED:

- Knowledge of machinery and tools
- Knowledge of dragsters
- Scientific knowledge about aerodynamics and physics
- Experience of the design process.

Possible supporting strategies

Discuss racing cars and their various forms. Introduce dragsters with photos from the Internet. Prompt students to share with a partner why dragsters are the shape they are.

Provide opportunities for those who share a first language other than English to discuss the topic in this language. If appropriate, provide reading material about aerodynamics in students' first languages to explore and discuss before reading this text.

TEXT FEATURES AND STRUCTURE:

- Language signalling sequence, for example, "Once they've each finalised their design", "and then", "before tidying it up", "Next"
- Language signalling different types of relationships between ideas, for example, "means" (effect); "If" (condition and consequence); "causes" (effect); "because" (reason); "by running" (how a purpose is achieved)
- Language for making comparisons, for example, "the fastest", "the most important", "the most aerodynamic", "the best shape", "shorter is better", "longer", "heavier", "slower", "thicker"
- Scientific explanations in text boxes
- Diagram of aerodynamics, with a key
- Explanatory text for CO^2 propulsion
- Close-up photographs with captions.

Possible supporting strategies

Before reading, support the students by linking to their prior knowledge of racing cars. Discuss the need for speed and that aerodynamics is the study of how different factors affect the movement of objects. Use the text box on page 20 (Aerodynamics: The ins and outs ...) as a separate focus either before or during the reading.

If necessary, help the students understand long complex sentences by breaking them into separate clauses and identifying the main ideas of each clause and how they are connected. Using who, what, where, when, how, and why as prompts, and breaking down the information together, can help students to identify the main ideas. For information about language for recounting and explaining and ideas on how to support students, see *Supporting English Language Learning in Primary Schools: A Guide for Teachers of Years 7 and 8*, pages 20–29 and 50–69. For information about ordering and a PDF of this booklet, go to http://esolonline.tki.org.nz/ESOL-Online/Teacher-needs/Reviewed-resources/Supporting-English-Language-Learning-in-Primary-School-SELLIPS

Sounds and Words

Instructional focus – Reading

English (Level 4 – Structure: Show an increasing understanding of text structures.)

Text excerpts from "Red-hot Racers"	Students (what they might do)	Teacher (possible deliberate acts of teaching)
Red-hot Racers	*Students **ask questions** about the title. They use their prior knowledge, their understanding of the phrase "red-hot", and the photographs to **predict** what the text will be about.*	**ASK QUESTIONS** to support the students' predictions about the text. • Share with a partner what you think the purpose of a title is. • What do you think about the title "Red-hot Racers"? What is meant by "red-hot"? Why do you think the author chose to use this as a title? What effect does the title have on you as a reader? • Look at the photographs. Tell your partner what you think the article will be about. How do you know?
A moving shape that is streamlined (or aerodynamic) causes less disturbance to the air flowing around it. This means that there is less drag to oppose the thrust. In other words, a streamlined shape travels faster than a shape that is less aerodynamic.	*The students **make connections** between the brackets including "or aerodynamic" and their prior knowledge of reading factual texts to recognise that "streamlined" and "aerodynamic" mean the same thing.* *They **locate** and **evaluate** the connective phrases ("This means" and "In other words") that refer to the previous sentence. Students reread the first paragraph to confirm the meaning of "drag" and "thrust". They **synthesise** the information and ideas within the text to understand what "aerodynamic" means. Students check their understanding by referring to the diagram.*	**TELL** the students that the text box explains aerodynamics and that it includes scientific language. **PROMPT** the students to use strategies to understand the information. • When we come across sentences that have a lot of new information, as readers we need to slow down and pay close attention to the words and what they mean. What can help us? Ask the students to describe strategies they have used while reading previous factual texts. **ASK QUESTIONS** so the students articulate their strategy use and notice the features of the text. • What features of the text supported us as readers? • What is it about the way the paragraph is structured that supported you to understand the meaning of "aerodynamic"? (Use of brackets and connective phrases that signal information repeated in another way.) • Did you use anything that isn't in the paragraph? • How did you use the diagram? • How did you check the meaning of "drag" and "thrust"?
"We test the cars by running them down a ramp," explains Andy. "If they don't run straight, you have to identify the reason. It could be that the wheel nuts are too tight on one side of the car or that the axles are bent. Axle holes that haven't been drilled parallel can also cause problems." If they are too tight, the wheels won't spin, and it's important that they run freely. For these cars, wheels with a bit of wobble actually do work the best.	*Students **visualise** a car not running straight down the ramp. They make **connections** between their prior knowledge and "on one side of the car" to understand why the cause of the problem could be the wheel nuts.* *Students **locate** the words and sentence structures that link and signal relationships between ideas and use them to identify these relationships.* *Students **ask questions** to understand the effect of the wheels on the speed of the cars. They **locate** and **synthesise** information from across the text (rejecting competing information) to conclude that in order for the cars to work effectively and run straight, the wheels need to be loose and slightly wobbly.*	**PROMPT** the students to visualise the car not running straight. **PROMPT** the students to locate the words and sentence structures that link and signal relationships between ideas. • When I read the first sentence, I notice the words "by running". These words link the ideas of testing the cars and how they do that. What other words can you find that link or signal relationships between ideas? **MODEL** asking and answering questions to understand the importance of the wheels on the cars. • As I read, I ask questions in my mind to help me fully understand the text. • I know that the cars need to run in a straight line, and I am wondering how the wheels affect this. There is information about other reasons why a car might not run straight that I need to think about too. • I have a picture in my mind of a ramp and think about how the car might go to one side. When I read the part about the wheel nuts being tighter, I ask myself why the nuts being too tight would make a difference. Then I remember that the text previously says that the students want a car's wheels to wobble slightly so that it runs better. **GIVE FEEDBACK** • I noticed you referred to the diagrams and photographs to help you understand the information. Remember to look for connetions between diagrams, photos, and text next time you read a text like this one. • You made good use of the title and the photographs to predict what the text might be about. • You used the text features more deliberately to help you understand what you read.

METACOGNITION

- What prior knowledge did you have that helped you to understand this text? How did these connections help you?
- Have you found some topic vocabulary to put into your vocabulary notebook? Why did you choose these items? What do you need to write about for each vocabulary item?
- Did you reach any conclusions? What did you do to reach them? What information did you synthesise to support your conclusions?

Reading standard: by the end of year 8

The Literacy Learning Progressions

Assessment Resource Banks

Instructional focus – Writing

English (Level 4 – Structure: Organise texts, using a range of appropriate structures.)

Text excerpts from "Red-hot Racers"	Examples of text characteristics	Teacher (possible deliberate acts of teaching)

A car that has a small surface area and sits close to the ground suffers less drag because there is less airflow over its surface, both around and underneath it.

SENTENCE STRUCTURE

In informational texts, authors sometimes use long sentences that contain a lot of information.

A car that has a small surface area and sits close to the ground
This noun phrase is the subject of the verb "suffers". "A car" is the head of the phrase. The rest of the phrase is a relative clause that describes what kind of car.

because there is less airflow
The conjunction "because" connects the two clauses of the sentence. "Because" signals that the part of the sentence before it is a result and what follows is a reason.

over its surface, both around and underneath it.
These prepositional phrases add information about the location of the airflow.

Ask the students to highlight (using different colours) the parts of the sentence.

- What is it? (a car)
- What kind of car is it? (one with a small surface area)
- What happens to it? (suffers less drag)
- Why does it happen? (because there is less airflow)

Explain that the last phrase ("over its surface, both around and underneath it") expands on the why.

MODEL innovating on the sentence.

- When we write information, we can use longer sentences to add variety and to convey information quickly. I am going to use the order of information in this sentence as a model for my writing.
- First I will jot down the information I need to convey. I can then craft it into a sentence using what it is, what happens, and why it happens, and then expand on this – for example, where, how, or in what way.
- Have a look at your writing. Could you use this kind of sentence?

Many students will find the example sentence too complex to innovate on. You could begin your modelling with a simplified version, taking out the relative clause and/or the prepositional phrases. You could also provide more scaffolding by providing a writing frame (see below for an example), by co-constructing several models with the students, and then by giving them cloze sentences to work through before they use the writing frame independently.

Result			Reason			
subject	verb	object	**because**	subject	verb	object

Aerodynamics:
The ins and outs ...

IDIOMATIC LANGUAGE

Use of idiomatic language in the heading can draw readers' attention and hook them in.

ASK QUESTIONS to encourage the students to comment on the author's choice of language.

- Why did the author use the term "The ins and outs …" as part of the heading?
- Does this add to the heading? If so, how?
- What would be the effect if it just said "Aerodynamics"?

EXPLAIN that factual texts sometimes use less formal language, especially if it suits the audience and gains their interest. Ask the students to reflect on their own writing.

- Who is your audience? Are your headings formal or informal? What impact might they have?

Two switches, one at each end of the racetrack, are used to time each car as it covers the 20 metres. The times are recorded on a laptop. Jerry is the race starter. He makes sure the cars are attached properly to the starting mechanism.

SUBJECT-SPECIFIC VOCABULARY

Use of subject-specific vocabulary adds precision and accuracy to a text.

PROMPT the students to check their vocabulary choices in their writing as part of their editing and revision process.

Remind the students that:

- using subject-specific language adds precision and accuracy to their writing
- readers expect texts to have accurate and appropriate language
- their initial planning included a vocabulary list, which may be useful to refer back to.

GIVE FEEDBACK

- You have been experimenting with different sentence structures. That gives you lots of choices as a writer.
- You have added more specific vocabulary when you did your revision. Those changes have made the paragraph much clearer.

METACOGNITION

- Which planning strategy helped you to sequence and organise your ideas the best?
- How did you decide what language to use in your headings?
- How did the modelled sentence structure support you to convey information? How have you used this learning with another sentence structure?

Writing standard: by the end of year 8
The Literacy Learning Progressions