UBC Vantage College Science

Speaking and Writing Physics 101:

The Language of Solving First-year Physics Problems

OER TEXTBOOK

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Textbook unpacks the role of language in 1st year physics

The textbook combines the perspectives of physics and language to help physics students understand and solve first-year problems more consciously and effectively.

The textbook aims to accomplish this by addressing two large gaps in tertiary science education as a whole and in first-year physics instruction in particular:

- it takes as a point of departure the perspectives, interests and experiences of international multilingual science students
- It explicitly addresses the mediating role of language systems and choices in constructing valued physics knowledge across high-stakes pedagogical genres.

Teaching & Learning Contexts

An open educational resource (OER) available on Pressbooks, the textbook can be used in self-study, group study, or instructor facilitated contexts of

1. tutorial sections of the physics courses focusing on problem-solving competencies and communicating solutions
2. linked content-and-language syllabi such as an English for First-Year Physics course.
3. advanced placement high-school science programs
4. pre-sessional university preparation programs.
5. refresher courses for first-year physics

The Physics Perspective

The textbook opens with instruction in effective strategies for solving word problems in physics. The units then present physics problems linked to the set of physics concepts typically taught in first year – from linear motion to fluids – focusing on how students with various physics competencies solve the problems in dialogue in groups and report their solutions with rationale formally in writing.

By exploring the various competencies involved in solving physics problems and illustrating these competencies in solutions produced by students with different strengths and weaknesses, this textbook aims to help students understand and develop their own competencies.

Organization

Unit	Physics Topics	Language Features
1	Motion Along a Straight Line	Units and Scales of Language as a Meaning-making Resource
2	Constant Acceleration	Doing and Being
3	Motion in 2 & 3 Dimensions	Entities Involved in Doing & Being
4	Newton's Law	Circumstances of Doing and Being
5	Application of Newton's Law	Logical Connection & Progression
6	Work & Kinetic Energy	The Concrete – Abstract Spectrum
7	Potential energy, Conservation of Energy	Information Density

The Language Perspective

Across the 14 units, the textbook describes and explains the functional scope of the English language in shaping valued physics knowledge.

For example, we explore the use of particular functional structures of English that physicists typically use when a problem requires us to re-interpret the concrete, physical world in terms of abstract concepts, such as when modelling a running person (concrete) as a point mass (concept).

Some questions users can answer

- What are the functions of language in solving physics problems?
- How does language help us to shift perspectives between a problem's dynamic, physical situation and the stable, theoretical concepts involved?
- What are the roles of visual figures and mathematical symbolism relative to language in solving physics problems?
- What language choices are involved in effectively solving a physics problem in group dialogue and writing?
- Can we distinguish between reporting and explaining our solution? If so, how?
- What does it mean for a solution to be effectively communicated?

Strategies for Engagement

Task-based learning

The textbook adopts a task-based syllabus with little fronted instruction. Learning occurs as learners engage with tasks, input their responses, and receive and review feedback.

Gamification

Advancement between textbook units is gated with a learning game involving a single Rube Goldberg machine comprising of 12 phases; the nature of RG machine phase corresponds to the physics concept in focus in the completed unit.

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