

Bayesian Reasoning for Diagnosing Student Misconceptions

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<http://online.edfac.unimelb.edu.au/485129/DecProj/index.htm>

Aim

To create an engaging and exciting adaptive learning system that can be used at home or school to teach students to interpret decimal numbers correctly.

Rationale

Many students have misconceptions about the meaning of decimal numbers. Standard instruction at school is often not very effective and students need instruction at very different times. A system that students could use individually and that targets their thinking might help.

Ingredients

Six computer games, designed to provoke cognitive conflict.

A short, reliable diagnostic test

Very detailed understanding of students' (mis)conceptions about decimal notation.

A Bayesian net to diagnose students, select appropriate game situations and track progress.

Progress

Games designed and trialled.

Trialling instruction ("help") to add to games

Research data on incidence of (mis)conceptions and progress from Grades 4 to 7.

A simplified Bayesian net working to diagnose students.

Characteristics

An adaptive learning system aimed at conceptual change.

Situations designed to provoke cognitive conflict

Teaching help is based on linking representations

Teaching help is based on "diagnostic teaching"

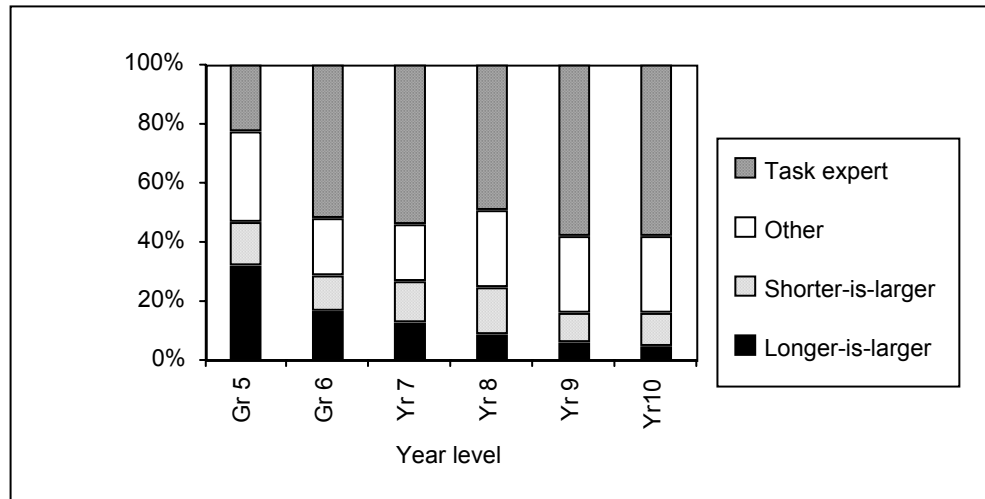
How students interpret decimal notation

- Some students aged 9 have a sound (although incomplete) understanding
- About a quarter of 16 year olds do not interpret decimals correctly
- Younger students tend to choose longer decimals as larger (blue on chart) – we have uncovered an unexpected variety of reasons for this.
- About 10% of students from Grades 6 to 10 choose shorter decimals as larger (yellow on chart) - – we have uncovered an unexpected variety of reasons for this.
- About 5% of students have no interpretation of decimals beyond the second decimal place – they only think in terms of dollars and cents and late digits are perceived as “errors”.
- Students’ interpretations of decimals depends on their teachers. The table below shows the average percentage of students by grade level and by classification. It also shows the maximum and minimum percentages in individual classes.

	Longer-is-larger misconceptions			Shorter-is-larger misconceptions			Task expert		
	min%	av%	max%	min%	av%	max%	min%	av%	max%
Gr 5	14	32	52	7	15	30	9	23	30
Gr 6	7	17	48	0	12	37	0	52	82
Yr 7	2	13	21	2	14	28	31	54	85
Yr 8	1	9	23	12	16	18	30	49	70

Yr 9	5	6	7	6	10	14	54	58	63
Yr 10	4	5	10	8	11	14	52	58	69

ALREADY HAVE HIS CHART _ DO NOT NEED ANY WORK ON THIS PAGE



Distribution of classification by grade/year level (over 2000 students)

