Investigating Students' Understanding of Wavefront Aberrometry

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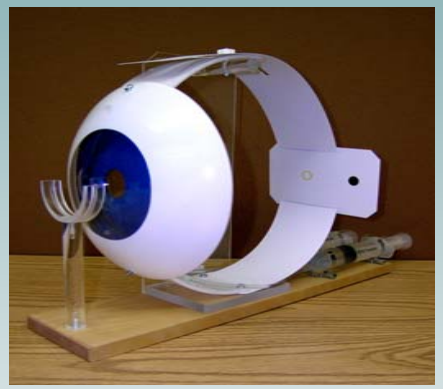
Research Question:

How do students use their existing knowledge to understand wavefront aberrometry methods of diagnosing vision defects and what resources do they use in constructing their understanding?



Methodology:

- formal, semi-structured interviews with twelve students (3 females, 9 males)
  - ➢ enrolled in a calculus-based introductory level physics course
  - ➢ interviewed before they had instruction about mirrors/lenses, while learning about the electromagnetic properties of light
- interview began with the participants looking at an eye chart in order to place the interview in the context of diagnosis
- students were asked to explain how the human eye works
- discussion of traditional diagnosis techniques
- model of wavefront aberrometry
  - ➢ explain how such a system would work
  - ➢ advantages and disadvantages

Analysis:

- phenomenographic approach to illicit variations in student ideas instead of researcher conceptions
- students' responses examined to identify any resources
  - ➢ single participant
  - ➢ all participants to extract possible themes.

Resources that can be applied appropriately to wavefront aberrometry:

- *light entering a lens differently will focus differently*
- *looking at patterns and symmetry*

Resources may not necessarily be appropriate for understanding wavefront aberrometry:

- *light can be represented by a straight line*
- *big change in the grid represents a big aberration*
- *controlled experiments only measure one thing at a time.*

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Light and Lenses												
Light can be represented by a line	x	x	x		x	x	x		x	x	x	
Light is a wave	x	x		x						x		
Concavity/thickness/curvature of a lens changes the focus	x			x	x	x	x			x	x	
Aberrometry												
Light entering a lens differently will focus differently	x		x	x	x	x	x	x	x	x		x
An aberration is an anomaly					x			x		x		x
Size of change in grid reflects size of aberration	x				x				x			x
Symmetry has value						x				x	x	
Can only measure one thing at a time					x			x				
Objectivity												
"Objective" means no human opinion/interpretation			x	x	x		x					x
"Objective" means consistent (always same for everyone)		x		x	x		x			x		

Conclusions:

- most students have a large body of prior knowledge about the human eye and basic optics
- much scaffolding will be needed in order to facilitate the transfer of that knowledge to wavefront aberrometry techniques
- students have a significant body of resources that they use to understand aberrometry
  - ➢ some appropriately and some inappropriately
- students do not immediately recognize the subjective nature of traditional diagnosis
  - ➢ once prompted they both acknowledge and appreciate the value of objective methods