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Misconceptions in Wave Propagation and the Principle of Superposition: a short study of high school level understanding

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Background Information

- Studies have shown that college students have difficulty describing wave phenomena due to misconceptions[1-5]
- Object-like reasoning models are often used to understand waves[1]
- Misconceptions can arise from inappropriately applied reasoning models

Study Overview

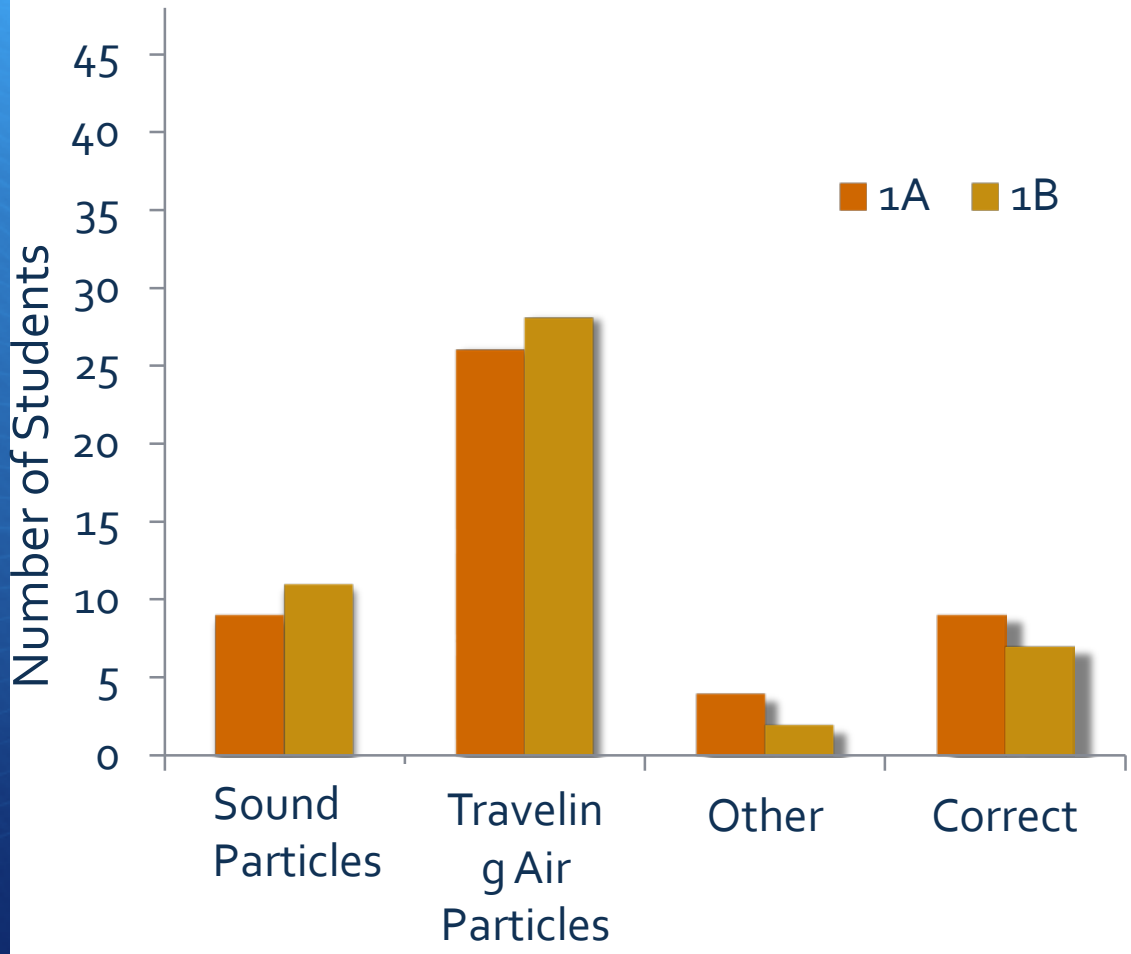
- Evaluated alternative conceptions that high school students have regarding wave phenomena
- Study conducted in urban specialized high school in Brooklyn, NY
- Two surveys were given to each student consisting of short response questions
- 48 high school juniors and seniors specializing in a technical field (civil engineering, biological engineering, aerospace engineering)
- Survey questions adapted from various studies that focused on uncovering misconceptions at the university level

Survey One

- Focused on the transmission and propagation of sound waves through various media
- Misconceptions:
  - The existence of sound particles
  - Traveling particles carrying sound
- Inconsistencies in description of "sound particles"

Results – Sound Waves

Propagation



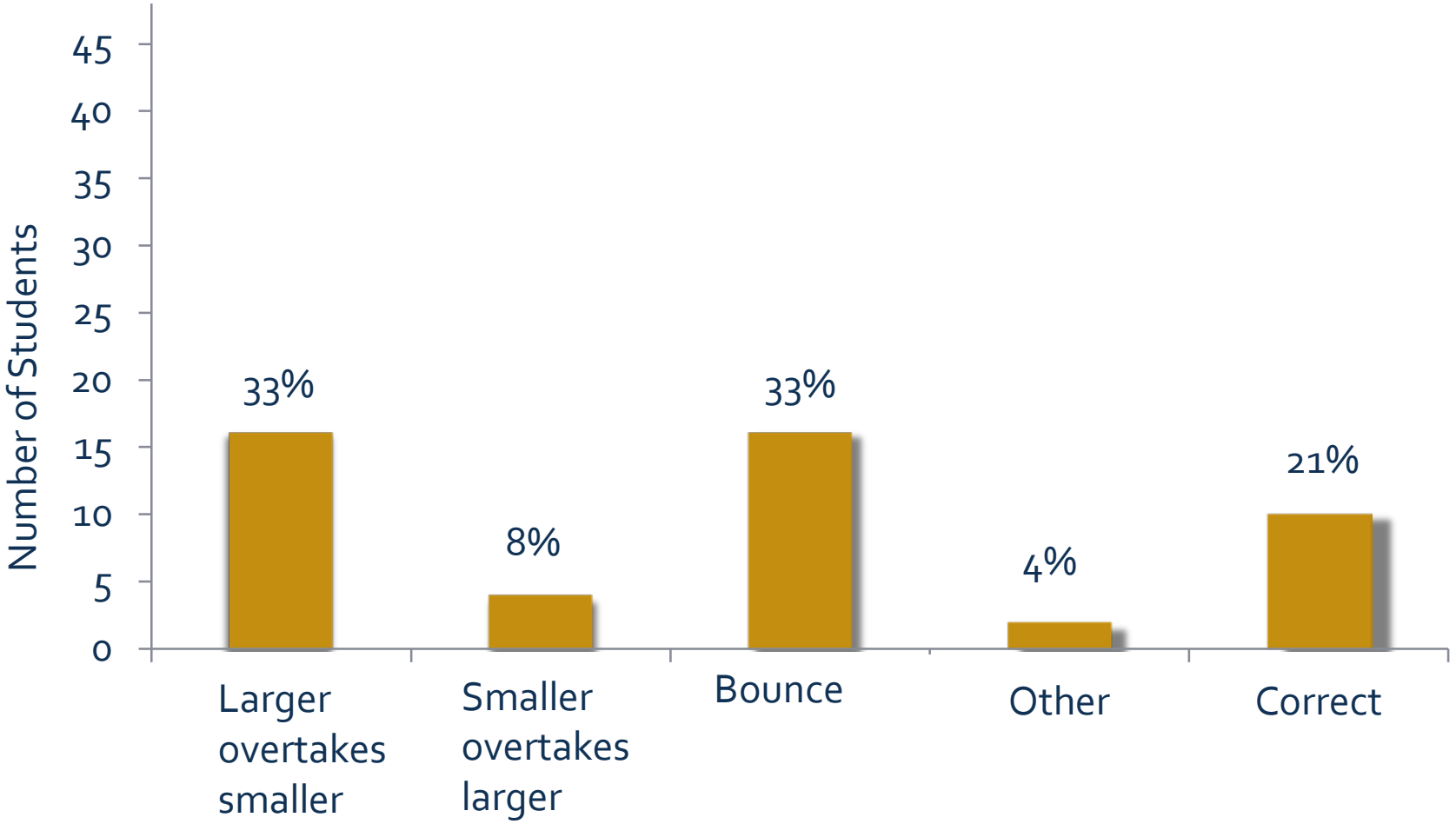
Part A:
- Correct: 19%
- Sound Particles: 19%
- Traveling Air Particles: 54%

Part B:
- Correct: 15%
- Sound Particles: 23%
- Traveling Air Particles: 58%

Survey Two

- Focused on the transmission, propagation, reflection and superposition of mechanical waves on a string.
- Misconceptions:
  - the speed of a pulse on a string is not dependent on the properties of the medium
  - superposition does not permanently affect wave pulses traveling along a string

Results - Superposition



Conclusion

- High school students have difficulties in establishing a coherent understanding of waves
- Misconceptions may be a result of inappropriately applied reasoning models[3]
- Identifying mental models that students commonly misuse can help inform instruction
- Identifying and addressing these issues at an early stage may help foster a more coherent understanding at university levels

Further Research

- Pre and post evaluations
- Specifically addressing alternative misconceptions where they exist
- Effect that focused instruction has on understanding waves

References

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4. Tongchai, A. Arayathanitkul and Soankwan. *The Persistantce of Students' Alternative Conceptions in Wave Propaga- tion.* in UniServe Science teaching and Learning Research Proceedings. 189-191.

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Q&A