Novel Teaching Techniques

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Peter M. McGinnis
Kinesiology Department
State University of New York
College at Cortland
peter.mcginnis@cortland.edu
Novel?

- Socrates had novel techniques
- Most teachers - including me - have adopted and adapted teaching techniques from others
Guidelines for good teaching

- Encourage contact and ways of learning between students and faculty
- Develop reciprocity and cooperation among students
- Encourage active learning

(Chickering & Gamson, 1987)
Guidelines for good teaching

- Give prompt feedback
- Emphasize time on task
- Communicate high expectations
- Respect diverse talents

(Chickering & Gamson, 1987)
Good teachers...

- Enthusiastic
- Knowledgeable
- Confident
- Patient
- Fair
- Flexible

- Organized
- Caring
- Respectful
- Funny
- Cooperative
- ....
Pete’s principles

- Reinforce correct preconceptions
- Challenge faulty preconceptions
- Encourage play
- Stimulate curiosity
- Guide discovery
- Make it fun
- Make it personal
Typical class structure

- Lecture
- Lab
- Tutorial/problem solving
Lecture

- Story telling
- Demonstrations
Story telling: static equilibrium

• Skiing with my sister and my nephew, Scott
Story telling: $V = \omega r$

- My racquetball racquets
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- My racquetball racquets
Story telling: $V = \omega r$
Story telling: \( a_r = \frac{v^2}{r} \)

- 2000 U.S. Olympic Trials: 200 m finals
Story telling: $a_r = \frac{v^2}{r}$

- What was Brian Lewis thinking?
Demonstrations

- Describe the demonstration
- Ask students for predictions
- Discussion between students
- Discussion as a class
- Vote
- Perform demonstration
- Ask students what they saw
- Discussion -
Demonstrations

- Toys
- Everyday objects
- Simple
- Complex
Toys - Projectile motion
Toys - Projectile motion
Toys - momentum

- Newton’s yo-yo
Toys - COR

- Deadly SuperBall™ trick
Toys - COR

- AstroBlaster™
Toys - impulse-momentum

- Toys that give
Toys - center of gravity

- Stability and balance
Toys - center of gravity

- Unexpected movement
Demonstrations - complex

- Tablecloth trick with pole, ball, and paper
- Friction, moment of inertia, impulse-momentum, torque...
Demonstrations - complex

- Unbalanced barbell - will it fall straight - or will it rotate?
Demonstrations - complex

- Unbalanced barbell - will it fall straight - or will it rotate?
Demonstrations - oops!

- Some demos won’t go as expected
- Use these as teaching moments
Demonstrations - oops!
Demonstrations - oops!
Laboratory activities

- Play - experiential
  - Qualitative
  - Discovery thru play
- Formal experiment
  - Pose hypothesis
  - Collect data
  - Quantify results
  - Reach conclusion
Laboratory - play

- Discuss concepts
- Play
- Discover
- Discuss
Laboratory - play

- Angular momentum
Laboratory - play

- Angular momentum
Laboratory - play

- Impulse-momentum & water balloons
Laboratory - formal

- Discuss why - hypothesize
- Explain procedures
- Collect data
- Evaluate
- Discuss
Laboratory - formal

- Newton’s 2nd Law - bathroom scale

\[ \sum F = ma \]

\[ R - W = ma \]
Laboratory - formal

- Simulated head impact - unpadded
Laboratory - formal

- Simulated head impact - padded
Impact forces - padded vs. unpadded

Time (s)

0 0.01 0.02 0.03 0.04

0 500 1000 1500 2000 2500 3000

Unpadded
Laboratory - formal

Impact forces - padded vs. unpadded

Time (s)

Padded
Unpadded
Laboratory - formal

- Running - Changes in step rate & step length as running speed changes
- Sprinting - Velocity changes through 100 m
Laboratory - formal

- Sprinting with...
  ...jumping stilts!
Happy biomechanics

- Have fun!