Enhancing Students' Understanding in Simple Harmonic Motion by Using Video Analysis

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Outline

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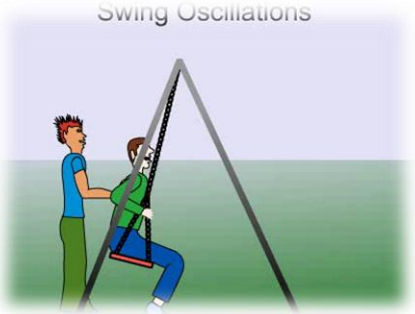
- **Conclusion**

Introduction: Why we study SHM?

Simple Harmonic Motion (SHM)



SHM concepts are important in physics and several applications.

⬇

Students should understand both theoretical representations and calculations to effective understand. ✓

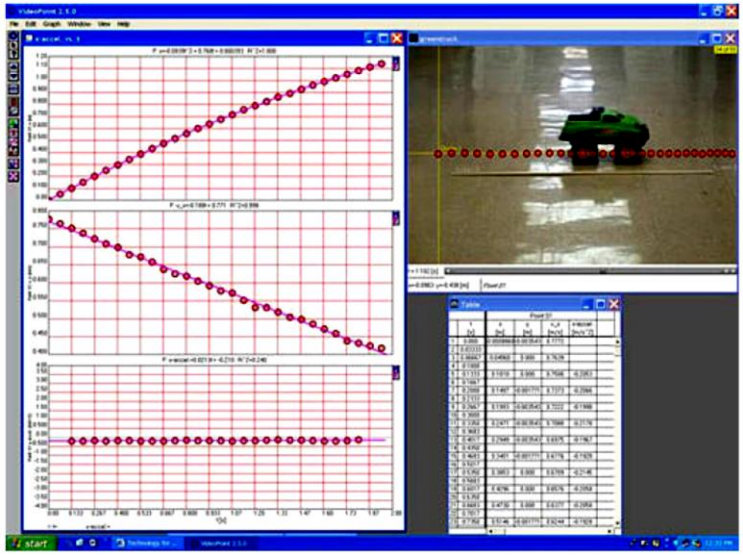
But

✗ mathematical calculation make student shy away

✗ most students have difficulties in relating concepts with graphical representation

Introduction: Why we use video analysis?

Video analysis:

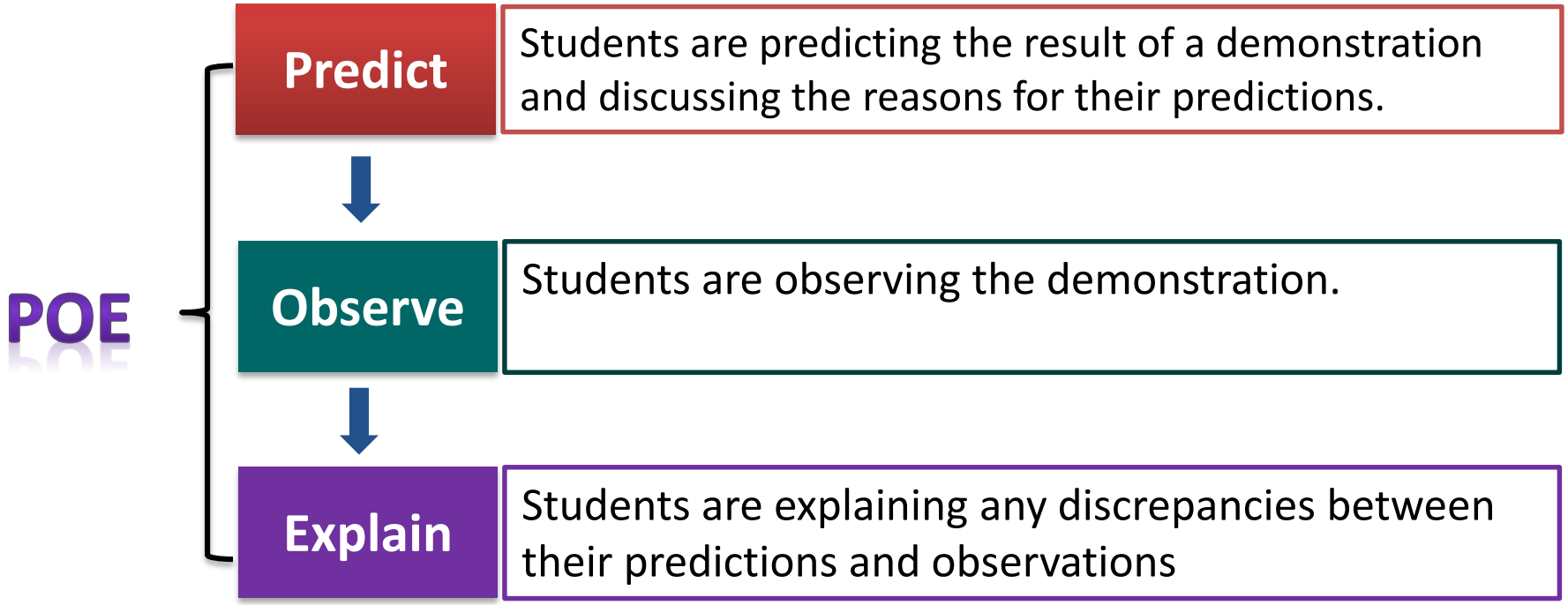


- The cost of equipment is minimal.
- Allows for the study of motions that not easy to do in the traditional lab.
- Allows real-world situation analyzed.
- Multiple representations (Graphs, diagrams, tables and strobe picture) are support students' understanding by building a link between theory and experimentation.
- Students can analyze complex situation even if they don't have strong mathematic skill.

(Desbien, 2011) (Klein, Gröber and Müller, 2014)

Introduction: POE approach

White and Gunstone (1992) have promoted the **predict–observe–explain (POE)** procedure as an efficient strategy for eliciting students' ideas and also promoting student discussion about their ideas.



(Kearney, Treagust, Yeo and Zadnik, 2001)

Objective

- To enhance students' understanding of velocity, acceleration and restoring force of SHM by using POE approach integrated with video analysis.

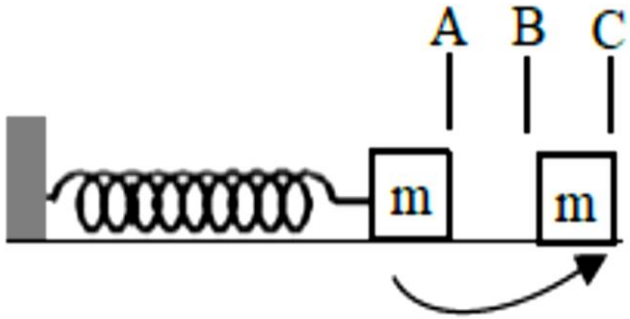
Materials and methods

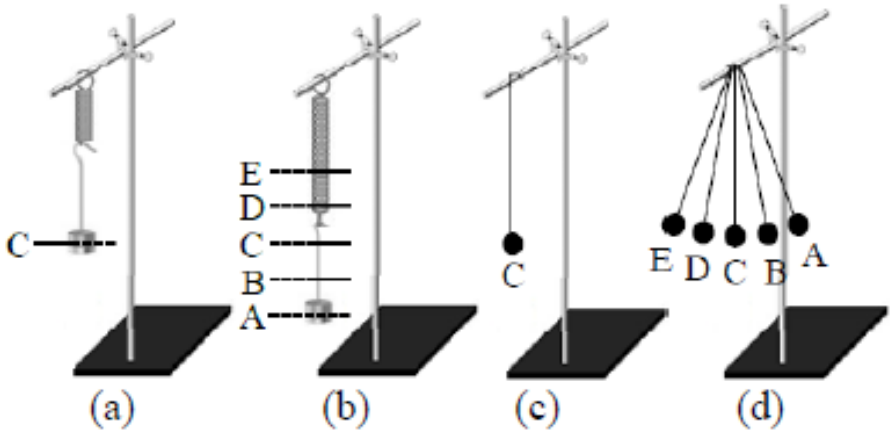
Participants

- 37 ten grade students at Satrichaiyaphum school, Chaiyaphum province, Thailand.

Instruments

- Six items SHM conceptual test





Mass attached spring *Simple pendulum*

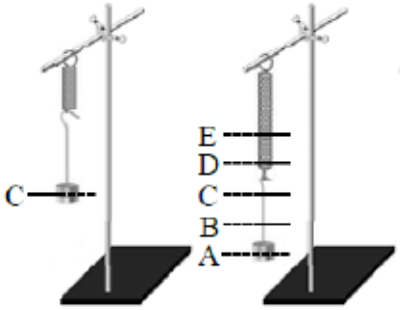
- Worksheet and two lesson plans based on POE approach

Data collection

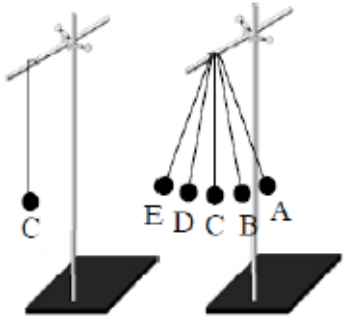
Pre-test → **Students did the activity based on POE approach** → **Post-test**

Predict | **Observe** | **Explain**

by using "VDO analysis"



Mass attached spring



Simple pendulum

❖ *Students did experiment and collect data.*

❖ *Students analyzed data.*

Data analysis

- **Five levels of student understanding following Westbrook and Marek, 1991 :**

NU ➡ incorrect information+ don't explain anything

AC ➡ incorrect information

PS ➡ understand concept +misconception

misconception understanding

PU ➡ not completely scientific understanding

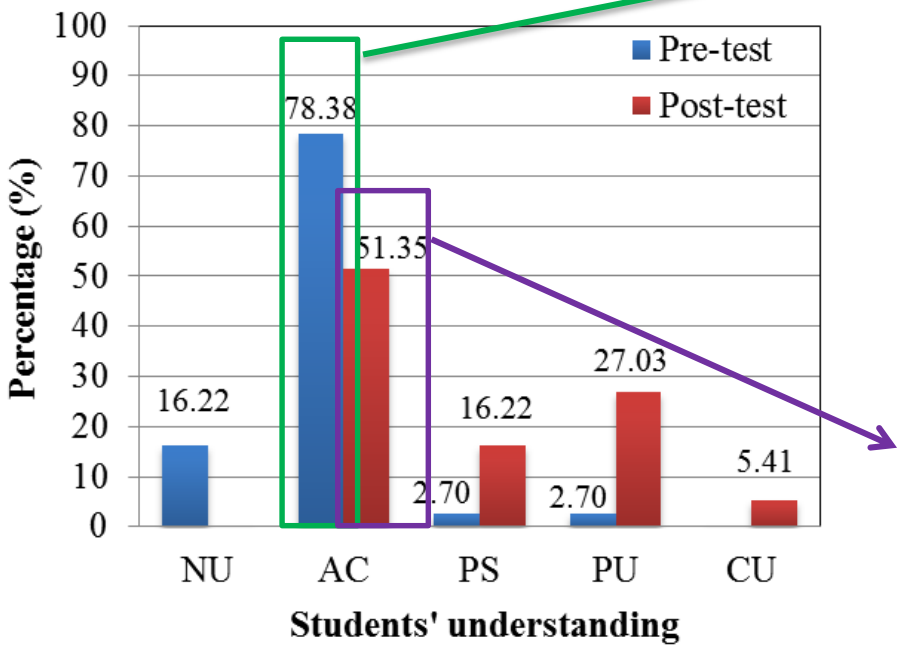
CU ➡ completely scientific understanding

scientific understanding

misconception understanding in pre-test ➡ scientific understanding in post-test = **students' understanding was developed**

Results and discussion

Students' understanding in magnitude of velocity



❖ **Misconception in pre-test:**

- velocity of SHM is constant
- velocity equals zero at equilibrium point
- magnitude of velocity direct proportion to displacement and restoring force

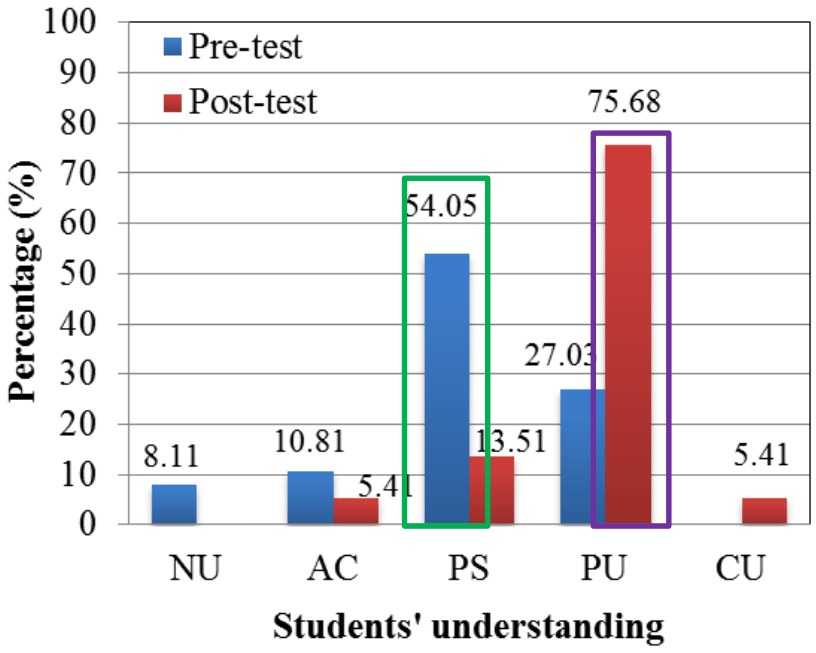
❖ **Misconception in post-test:**

- velocity equals zero at equilibrium point and maximum if displacement is maximum
- magnitude of velocity depend on restoring force and no restoring force at equilibrium point

The students' understanding was developed 29.74%.

Results and discussion

Students' understanding in direction of velocity



The students' understanding was developed 55.06%.

❖ Misconception in pre-test:

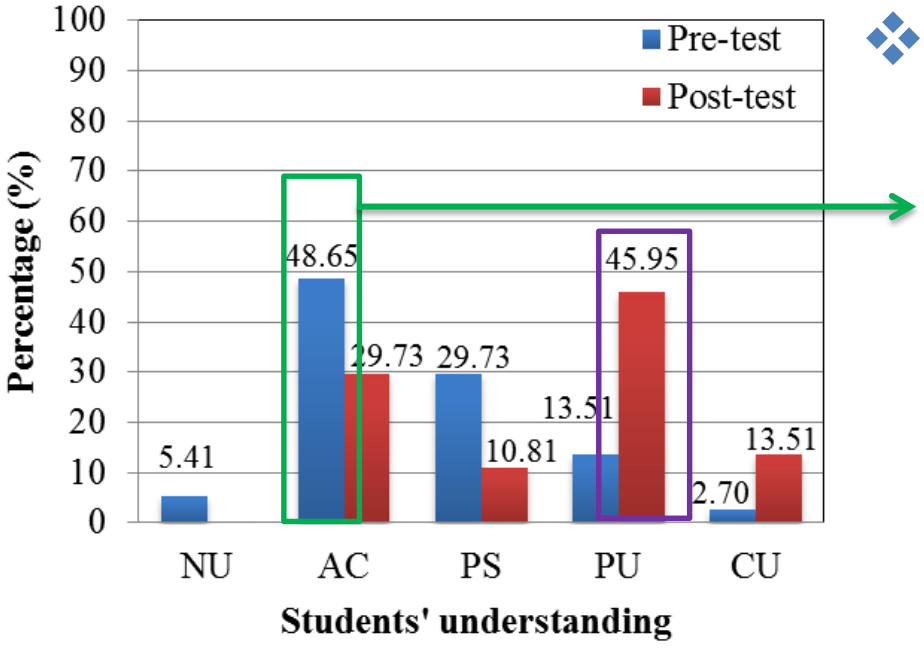
- direction of velocity same as direction of force act to mass attached spring
- direction of velocity is opposite with the direction of object movement.

❖ Misconception in post-test:

- direction of velocity similar to object movement
- it is the same direction both objects go away and return

Results and discussion

Students' understanding in magnitude of acceleration



❖ Misconception in pre-test:

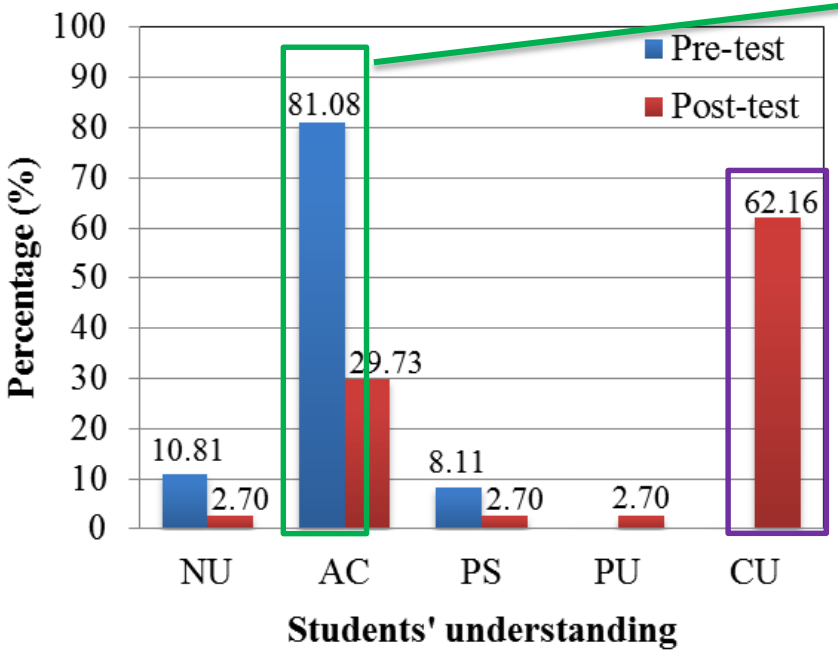
also found in post-test

- Acceleration is zero at maximum displacement.
- Acceleration is constant.
- Acceleration depends on force and mass.
- Acceleration is diverse portion with displacement.

43.25% of student was developed to scientific understanding

Results and discussion

Students' understanding in direction of acceleration



❖ Misconception in pre-test:

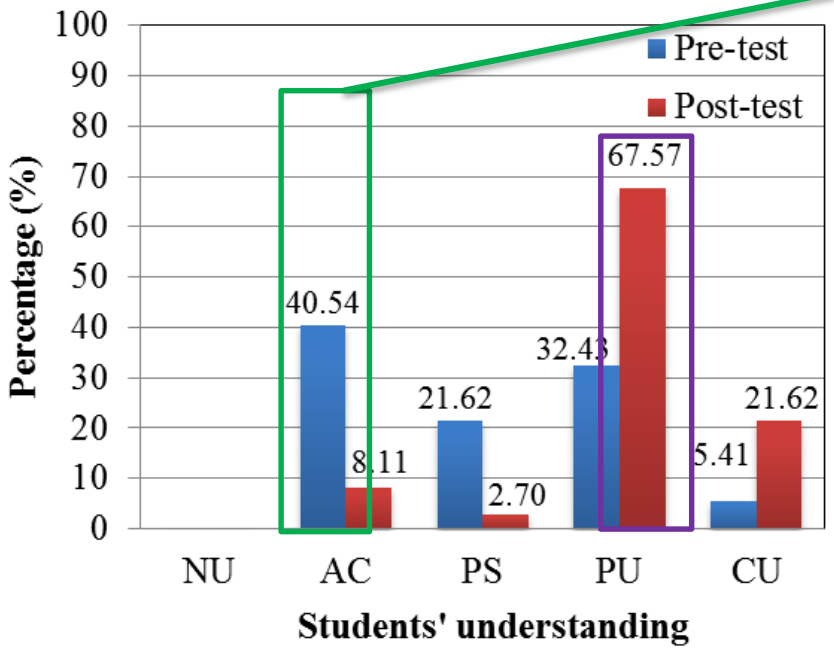
- Direction of acceleration is opposite when mass turns back.
- Direction of acceleration is similar to velocity.
- Direction of acceleration follows to the direction of the moving object.
- Direction of acceleration difference from force.

found in post-test

64.84% of student was developed to scientific understanding

Results and discussion

Students' understanding in magnitude of restoring force



❖ Misconception in pre-test:

- Restoring force is constant.
- If object is near equilibrium point, restoring force is increased.
- Restoring force is decreased when it is near equilibrium point.
- Restoring force is direct portion of velocity.

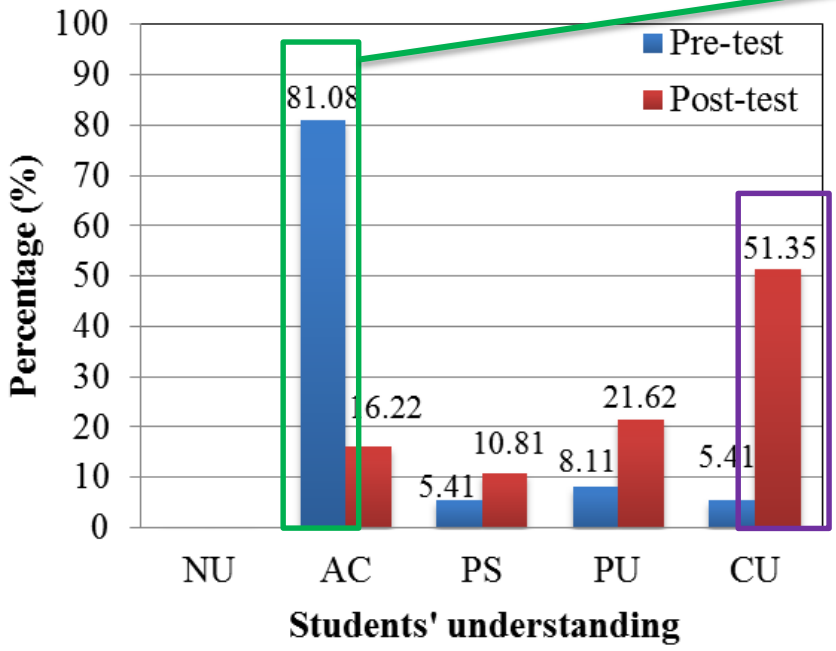
❖ Misconception in post-test:

- magnitude of restoring force reverses to displacement.

51.35% of student was developed to scientific understanding

Results and discussion

Students' understanding in direction of restoring force



❖ **Misconception in pre-test:**

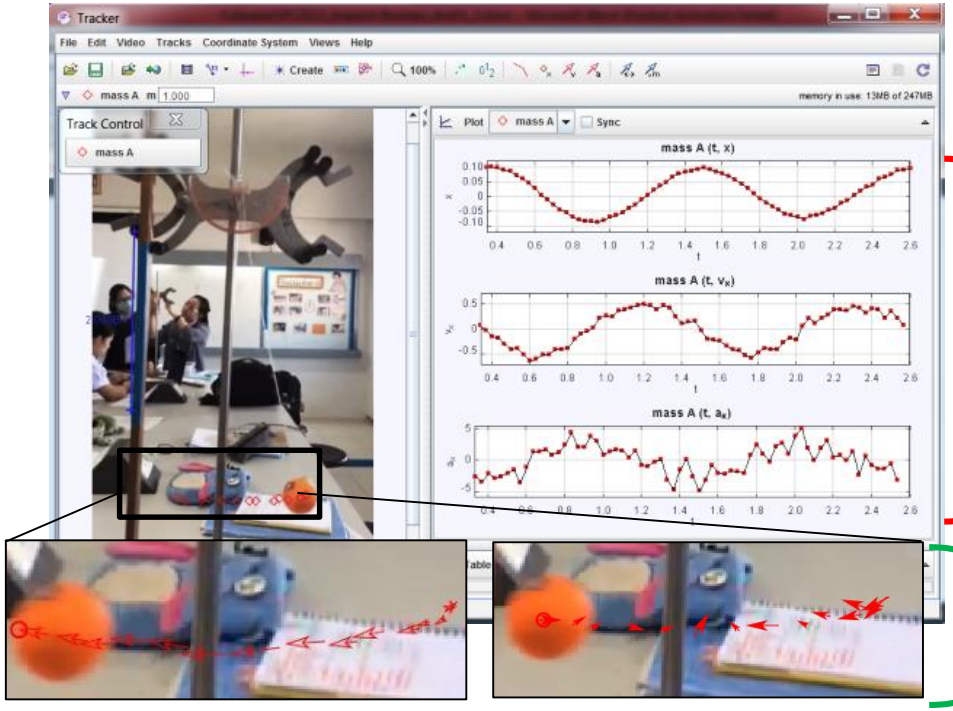
- Restoring force is same/difference direction of force used for pulling mass.
- Direction of restoring force is difference when mass returned.
- Direction of restoring force point to the equilibrium point because of elastic potential energy.

- restoring force on the object is on the reverse motion of object.

found in post-test

59.45% of student was developed to scientific understanding

Conclusion



Direction of velocity Direction of acceleration

- The POE approach with video analysis can improve students' understanding of velocity, acceleration and restoring force, especially direction (>50%).
- The magnitude can be compared and studied the relationship of graph representation from the video analysis.
- The direction was clear to see from analysis results by using video analysis.

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