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A HINT ON A SHORTAGE OF MANPOWER IN PHYSICS

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ABSTRACT

Misinterpretation of Physics texts from foreign books into Thai has been found occasionally. Recently a clear evidence resulting from that kind of error was seen in common among Thai secondary school students of the whole country. It is the concept of Galileo's falling bodies. They all wrongly claimed that Galileo dropped two bodies of different weights from the Leaning Tower of Pisa to the ground at the same time. More lately the same misunderstanding is found in a recently published Chinese science storybook. Another Thai physics storybook reports a more reasonable explanation about his experiment on an inclined plane, which is related to the freely falling bodies. Unfortunately, it gives a doubtful information by pointing that Galileo uses his pulse to measure the falling times of the rolling down balls. In reality this could be impossible. These evidences show a long time confusion among people of the countries. Although using a commonsense can eliminate this simple issue, instead, people think physics is hard to understand. As a result they avoid taking physics as a major.

Keywords : Galileo's falling bodies, free falling, inclined plane, air resistance, gravitation acceleration.

INTRODUCTION

A science camp was held during 21-27 October 2001 at Burapha University. The organizers invited secondary school students from every province of the country to apply. Each applicant was asked to write an essay for the committee to judge for attending. The topic was on "The Scientist in My Heart". Two most popular men were mentioned. Thomas A. Edison and Galileo Galilei.

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It seems they do not know the distinction between a scientist and an inventor. Edison is a famous American inventor, not a scientist. More seriously, they all reported that Galileo dropped two different weights from the Leaning Tower of Pisa to the ground at the same time.

There must be something wrong in the science education in schools of the country.

A Chinese science storybook, entitled "The Stories of Foreign Scientists", written in Chinese and published in China in 2002, also has the same error (Ding, 2002).

It says Galileo let two steel balls of different sizes fall to the ground at the same time (see Picture 1).

Picture 1. A picture copied from page 29 of Ding (Ding, 2002). It says, "Two steel balls, one large and one small, were dropped from the Leaning Tower of Pisa by Galileo and they reached the ground at the same time. So, what Galileo said is right."

Another Thai Physics Cartoon Book written by Mr.Suwit Choawadej on the Galileo's experiment is in good agreement with many foreign physics books and publications (Shaowadej, 2001).

It tells about the experiment was carried out on an inclined plane. However, the way of timing the rolling balls by using his pulse is doubtful (see Picture 2). How can one record his own pulse in such a short period of time, especially a fraction of one second? It seems lack of rational grounds.

Picture 2. A picture copied from page 14 of Shaowadej (Shaowadej, 2001) illustrated in the Thai language. It says, "Galileo rolled down many balls along an inclined plane. He used his pulse as a clock".

OPPOSING ARISTOTLE

Over three hundred years ago, Galileo strongly acted against Aristotle's teachings, which lasted almost two thousand years. Among them he opposed Aristotle's saying that a heavy body falls faster than a light one. Many people before Galileo (see Richtmyer et al., 1969), in fact, had questioned that doctrine.

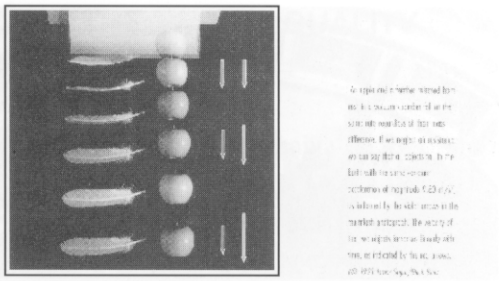
Going up the Leaning Tower to proof Aristotle was wrong is a legend. It is a folklore of science history. However, it is a world wide famous story.

PERFORMING EXPERIMENTS FROM THE TOWER?

Did Galileo really do his famous experiment from the Leaning Tower of Pisa? The answer is most likely to be "NO". Even some local people of

Pisa do not believe he did so (personal contact). People in general keep telling from one to another as a rumor.

However, there may be an evidence for the negative answer from one of Galileo's famous books, "The Dialogo". In a conversion, the reply of Salviati (Galileo's stand in) to Simplicio (Aristolian) indicates he dispensed such experiment (See Brown, 1993). He was too sure not to proof what Aristotle said. It is obvious that a feather falls much slower than a piece of stone does when both are simultaneously dropped from a height.



Picture 3. A picture copied from page 23 of Serway (Serway, 2002) illustrates an apple and a feather fell simultaneously in vacuum with the same rate. See the arrows for the increasing of the speeds of the two which are the same.

THE SAME SPEED

In many occasions one might find Galileo's conclusion on his falling body experiment that all bodies freely fall at the same speed. The phrase "same speed" may easily leads to a simple meaning that at a definite distance two bodies simultaneously dropped take the same travelling times. This is right, but it can not happen, by appearance in the case of the experiment from a tower.

Now imagine there are three things falling at the same time from the same height; a light ball, a heavy ball, and a set of the two balls (exactly the same sizes) being tied up together. Which one will reach the Earth first? (see Brown, 1993, for the answer).

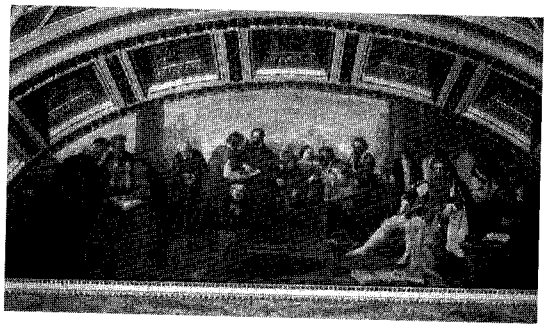
AIR RESISTANCE

It is generally known that air resistance retards the falling speed of an object. Two bodies with equal weight but different in shapes and sizes cannot travel at the same speed in air. In vacuum, all objects, regardless the mass, the shape and size, fall at the same rate (see Picture 3).

The long lasting confusion holds because people do not realize the existence of air resistance.

AN INCLINED PLANE EXPERIMENT

Most textbooks refer Galileo's experiment about falling bodies on an inclined plane. The drawing of the event can be found in many books (see, e.g., Picture 4). By rolling down a ball along the inclined plane, which can stand up right and the ball will fall freely. This is an analogous experiment, which was performed wisely. Therefore, his experiment has been honored to be one of the ten most beautiful Physics experiments by 'Physics World' journal. Johnson of the New York Times News Service reported on September 24, 2002. The details of the paper give even a clearer picture of the set up. The inclined plane has a dimension of 12-cubit (6 m) x 1/2 cubits (25 cm). A smooth and straight groove at the middle of the plane is for the balls to roll down. The falling times are measured by a water clock. This is done by letting water draining from a container through a pipe into a glass. The amounts of water are weighted as falling times. He concludes that the distance a ball rolling along is proportional to the square of its falling time. This is related to what we now know as gravitation acceleration, $g = 9.8\ m/s^2$ in approximation.



Picture 4. A picture copied from page 36 of Serway (Serway, 2002) illustrates Galileo doing his experiment by rolling a ball along an inclined plane.

CONCLUSION

It is certain that misunderstanding about Galileo's experiment on falling bodies is still existing. This error impresses children at the very beginning process of learning science. This is very important because it is the fundamental concept leading to understanding physics and others. They cannot think of their own very much to give reasons. They learn what they are told. No one actually explains to them the right thing even when they grow up. When they start to find out the reasons, most of them get confuse between the physical facts or phenomena and the principles of physics. They may feel curious, unhappy or even hate physics. Consequently, they give up and quit. A gap of manpower with physics background may be widened. This can affect the development of the country in the near future.

Some precautions maybe worth to mention here. Authors of the science storybooks and textbooks should aware more and perform more rationalization and responsibility. The publishers should have qualified staff to take care about the errors. The authorized government officials should take more actions. Well-educated parents should check their children about the funny lessons in science. Finally, teachers in charge should prepare their lessons much better. They should think harder and try to give reasons to themselves concerning the physics principles and the reality of the phenomena in nature. Most importantly if they are not well qualified, give them a more appropriate education before going to teach.

Working together as a whole, especially voluntarily, a needed well-organized science education system may be achieved. People can not stay ignoring. Do you really want our science status to be ranked at the very bottom of the region?

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