Did Galileo really test gravity by dropping objects from the Tower of Pisa?

What we do know!

Galileo returned to work on the theory of motion in 1602 and over the following two years, through his study of inclined planes and the pendulum, he had formulated the correct law of falling bodies and had worked out that a projectile follows a parabolic path.

Galileo experimented by letting objects fall toward the Earth, and he discovered that they underwent constant acceleration. Carrying out experiments, Galileo showed that the distance a body travels as it falls is proportional to the square of the time.

What we don’t know for sure!

In his writing Galileo keeps referring to dropping bodies from towers, and in more than one case specifically claims to have done repeated tests of this kind. There is no mention by Galileo that specifically states that he used the Tower of Pisa as one of the towers he dropped bodies from.

What Viviani described was not an experiment at all; it was a demonstration. Galileo already knew what would happen and used the Leaning Tower to demonstrate this to others. That would have been keeping with what is known about his flair for the dramatic.

The story had been challenged on several grounds, but principally because the decent is not strictly simultaneous in air, and because the university records show no trace of such an event, nor is it mentioned in contemporary letters. The controversy is aggravated by the habit of modern writers of referring to the event as an “experiment.”

There is no account by Galileo himself of such an experiment, and it is generally accepted by historians that it was at most a thought experiment which did not actually take place.

In all probability it did occur, but it was certainly not an experiment; it was a demonstration. Galileo had already arrived at the conclusion that the descent should be simultaneous form his (incorrect) buoyancy theory of fall.
I chose this question because it was completely new to me. I had never heard about Galileo testing gravity with the Tower of Pisa. I thought it would be interesting to see if there was any actual data from experiments he performed using the Tower of Pisa or if it is just something “made up” to make it sound more interesting.

I am not sure how I would use this in the classroom other than to show to the students that without hard evidence or data we are not certain that different things really happened. It would be fun in a science classroom to have the students do an experiment like this to demonstrate the laws of physics.

**Did Galileo really test gravity by dropping objects from the Tower of Pisa?**

* Perhaps the most important new ideas which *De Motu* contains is that one can test theories by conducting experiments. In particular the work contains his important idea that one could test theories about falling bodies using an inclined plane to slow down the rate of descent.

* In fact he had returned to work on the theory of motion in 1602 and over the following two years, through his study of inclined planes and the pendulum, he had formulated the correct law of falling bodies and had worked out that a projectile follows a parabolic path.

* In fact it was his theory of falling bodies which was the most significant in this respect, for opponents of a moving Earth argued that if the Earth rotated and a body was dropped from a tower it should fall behind the tower as the Earth rotated while it fell. Since this was not observed in practice this was taken as strong evidence that the Earth was stationary. However Galileo already knew that a body would fall in the observed manner on a rotating Earth.

*I assume that the speed acquired by the same movable object over different inclinations of the plane are equal whenever the heights of those planes are equal.*

He then described an experiment using a pendulum to verify his property of inclined planes and used these ideas to give a theorem on acceleration of bodies in free fall

*Galileo* experimented by letting objects fall toward the Earth, and he discovered that they underwent constant acceleration. Carrying out experiments, *Galileo* showed that the distance a body travels as it falls is proportional to the square of the time. However, stating the results in this way does little to show how brilliant they were, for they overturned the ideas of gravity as put forward by *Aristotle* which had been accepted as fact for nearly 2000 years.

* In *Dialogue Concerning the Two Chief Systems of the World* (1632) *Galileo* argues as follows “Release the two stones from a height to fall to Earth.”

*Galileo* had produced a stunningly clever “thought experiment" 

* watched a pendulum swinging and *Galileo*, however, saw that the bob went up and down. He essentially saw the movement as composed of vertical and horizontal components with gravity being the force in the vertical direction. Although the time taken for the bob to rise and fall depended on the length of the pendulum, it did not depend on the weight of the bob. Again his argument showed that, ignoring the resistance of the air, the time taken for an object to fall from a given height did not depend on its weight. Rolling balls down inclined planes also allowed *Galileo* to examine the downwards component of the speed of fall.
* While some of his earlier predecessors actually performed this experiment, Galileo did not. However, when Galileo was an old man, one of his students did perform the demonstration to an audience.

* There is no account by Galileo himself of such an experiment, and it is generally accepted by historians that it was at most a thought experiment which did not actually take place.

* He had, however, formulated an earlier version which predicted that bodies of the same material falling through the same medium would fall at the same speed.

* Galileo conducted several experiments with pendulums.

* The story had been challenged on several grounds, but principally because the decent is not strictly simultaneous in air, and because the university records show no trace of such an event, nor is it mentioned in contemporaneous letters. The controversy is aggravated by the habit of modern writers of referring to the event as an “experiment.”

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