

**(a) Discussion of Reading Galileo's Experimental Research**

**TA:** I love this guys, I absolutely find him incredibly fascinating; his full approach and everything, how he starts the Galileo and how he try to figure out what was going out on each stage. He portrays Galileo didn't write what things come after beginning of his explorations. He put down a series of experiments that let him to his discovery.

**DS:** One of the things that I like/agree him is: he is very systematic in his approach, he address the claims that the credits Galileo couldn't do these things. He not only refuted but also come over the experiment work and evidence published that here is why he couldn't possible to do this. I found that really interesting that a lot of things that he talk about anticipating a lot of discoveries: the uses of diagrams, the use of objects, pendulums, motions and movements.

**TA:** How Galileo figure out to measure time in a systematic way. It just reminded me of the massive ways and then you try to look up many things and look up for this perspective and that perspective and how one part can form to another. It takes a lot of experimentation before you come out with something clear.

**DS:** I like the beginning part where the students are sitting down to learn how the Newton Law and motions, how great and wonderful was we are just sit down to learn something. "Yes, this make sense." appears in our brain. However, Galileo does not have this opportunity to sit down in front of the textbooks and learn and absorb and move forward. He needs to struggle a lot of problems in order to move forward. It is really an humbling experience. I think I really begin to appreciate how these people accomplish so much with so little. It is so impressive!

**LJ:** Not having information on textbooks; Galileo's observations – "why isn't so?" when he see something is swinging. "It's interesting, I'm going to see on Google!," said LJ. I'm curious but my thought is that I'm going to find it, it is already exist in somewhere. May be about the different in my brain, my learning styles or the society that makes me think that it is already there. There is no need for me to discover instead of making me to say "I want to figure it out." Why do we have that thoughts? Do we assume that all the things have been discovered?

**DS:** Galileo did has a huge breath of things that he did and he has spent times on focusing on these specific things and never isolate these things from each other (such as the pendulum experiment influence his work on the motion experiment). In our current education system, we spent so much of time on learning something in a field, once you get the understanding. But never move to another field, you will never realize that you have all that body metaphor to continue working with in that new area.

**TA:** What propel you to have that thoughts? Pouring something in, pushing the balls into the water, where did the henge come from?

**YY:** Although we are now recreating Galileo experiments, we are exploring very different from Galileo. I feel like when he is doing the floating experiment, from the previous experiment (who discovered the floating) and about the free fall experiment, we don't have the same thinking before the question was posted. The center of the earth is the center of the universe. The motion is related to the astronomy and it is related in his mind. But we can't see this relations.

**DS:** Children are constantly making models of the world that can come up the model and understand the experience. I will get quick flash/pictures or conceptual which don't require a lot of my thinking and I will continue to work on what my intuition that come on my mind. As a human being, we try to do it naturally.

**LJ:** Yes, I also have moment of that. I just wonder how happen I remember those? I wonder how often I have been consciously expose to it? How often it existed in my life? I wonder that when do I being influence.

**DS:** I think you are totally right. Think about the Newton and the apple, which every one has the same experience in everyday. He has just enough of those, right place, right time and the right brain and this idea come to. No matter what time period you live in, will be everyday experiences and that will govern and influence your current thinking. That is how wonderful of the sciences. All of the great works of science is not rigorous and is very natural and free flowing. After that, some people go back and work out the details and make it all rigid (such as Electromagnetism).

**MC:** Since Galileo's background – his father is a musician and he also know how to play some musical instruments, that makes him very sensitive to the pulse/beats. For example, I have play some musical instruments when I'm young; during that period I'm very sensitive to the pulse/beats. It is a natural reaction to start to count something (such as something is swinging back and forward) using the pulse/beats which I have learned in the music lessons. How Galileo discovered things might have something related to his living background. A big influence in his daily life. I like the writer in the way he approaching to Galileo. I have the same questions in my mind too. Moreover, the writer wanted to figure out isn't Galileo figure out something at

once or over a period of time.

**LJ:** Museum and library, music and math. Math being the foundation of everything. Sort of developing my understanding, it's in my head in somewhere, gradually all the things join together in my head that help to build the picture of understanding, starts with the pieces that need not to be in order and eventually part of his very important pieces in his experiment which not recorded in his notebook.

**DS:** In science and everything else, finding the connection between things tends to be a lot of magic happen. A lot of times you know how to solve one problem and if you can figure out how this is like something else, you can get more quick examples. Once you find the similarities between two fields you can accomplish great things.

**(b) Vincenzo Gallilei, Fuga a l'unisono, 1584**

**Elizabeth:** Physics is about biography and Galileo is about biography; he has 50 years to learn these things and he realized that he is going to no where to stop.

It took Ms Elizabeth 6 hours to save this one minute music by Galileo's father: Contra punto prima (BM), Fuga (VG) and Contra punto eaudr (BM).

**(c) Our Motion activities from last time**

**TA:** When I went outside, I start to think everyday motion. I'm watching the cars and thinking "How can I tell that the vehicle is going to start or move?" And I found that watching the ream of the wheel was really helpful. I'm thinking how fast should I go or to cross the street. You have a walk light, I know if it gets down to 6 seconds, 5 seconds, I can't cross the street. I know how fast I need to go in relationship to the flashing light.

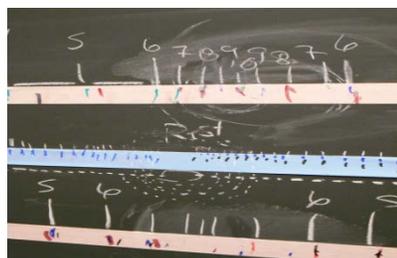
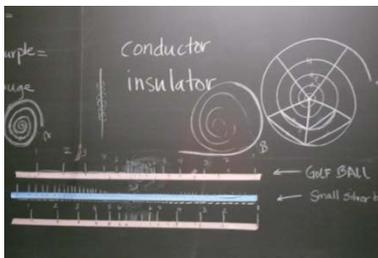
**LJ:** Do you ever set your alarm and you wake up 1 minute before the alarm? "Yes." Okay, I do that a lot. I wonder how my brain or has some sort relative concepts. I think this is how the timing develop in my mind.

**(d) Today Motion Exploring**



LJ and TA studied the motion of the sphere balls on a half-sphere track. First, they dropped the golf ball at the end of the track and let the ball rolls. They marked the height of the ball reached (every back and forward movement) on a tape. They repeated the same experiment two times in order to get more accurate results. Then, they repeated the experiment again with a small stainless steel ball. They noticed that the first height reached by the ball at the other end of the track is not as height as the first height drop. They suspected that this is because some energy has lost during the motion of the ball.

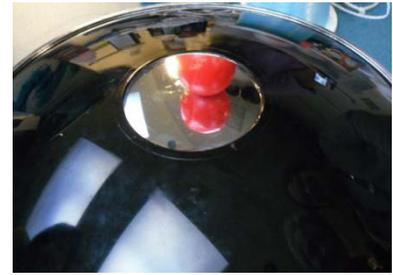
Moreover, they found that the pattern of the distance interval resembles a spiral pattern. The distance intervals getting smaller and smaller when the ball near the center of the track (for the last few oscillations before it stops completely).



#1 Golf ball	A	B
1-2	10	9
2-3	8.5	8.5
3-4	7	8
4-5	4.75	6
5-6	4.25	3
6-7	1.125	1
7-8	1.125	1.5
8-9	7.5	1.5
9-10	7	7

YY is thinking more about the projectile motion (horseman example) described by the Galileo in his dialogue with Sagredo and Simplicio. YY discovered that the ball will return to her hand if she threw the ball straight up to the air while she is running/walking with faster velocity. However, it is very difficult/impossible for her to catch the ball if she threw it forward while she is running forward. On the other hand, she found that the ball will travel in a diagonal direction if she threw the ball to her side way while she is moving forward. It was not easy for her to have the same observation if she threw the ball forward while she is moving forward. She suggested that it might be because she could not see the small different in the angle from the front view (where the ball is moving forward).

EE created a special “cook ball pot” where you can observe the holography effect. Look at the photo on the right: Where do you think the ball is? Sitting on top of the black cover? The center part of the black cover is made up of a mirror? You are probably cannot believe that the ball is sitting inside the black cover and the center part of this black cover is not made up of mirror; however, it is a hole. How can this happen? Here is the hint: the black cover is sitting on top of a mirror bowl where the ball is sitting at the middle of this bowl.



DS studied the relationship between time and measurement. He is more curious about the time keeping device is not constant which might affect the accuracy of the experimental results. In addition, he wanted to know more about how the convex lens work besides all the information given in the Wikipedia. He is looking into the details and its fundamental theory.

MC observed and recorded what experiments have other classmates done in the class. She also studied the properties of a golf ball and an elastic ball. She discovered that the elastic ball can hit the hard solid surface (e.g. Bare concrete floor or a wooden table surface) and bounce back to the air more frequently than a golf ball. Moreover, the height of an elastic ball bounce back to the air is much more higher than the golf ball. However, the total number of the bouncing is decrease when the contact surface getting less harder (e.g. a carpet floor or a jacket). It makes sense to her: a ball can bounce back easily on a wall. She claimed that it might be because more energy has been absorbed by the soft solid material than the hard solid material.

**(e) Outside Observing at the Great Court**

Finally, we have the chance to observe the night sky with Galileoscopes. Moreover, we can see the moon tonight. Everyone is so excited to set up the tripod and telescope at the Great Court. The image formed on this telescope is inverted. We can see there are some small cavities on the moon surface.



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