一杯醋的量，我们测了三回

科学节报名单上，我们小组填的项目是火山喷发。班主任签字的时候抬了一下眼皮：这个节目去年就有班做过，你们有什么不一样的？组长说：我们打算把喷发测出来。班主任把笔递回来，签了。

说不清楚从哪一刻起，我们不再把这件事当成一个节目，而当成一个问题。区别在于：别人只要火山喷起来，我们要回答的是，怎样喷得最高、最久。而这个问题，课本上没有现成的答案，只能自己做。

模型照旧做：报纸骨架，胶带缠绕，外面糊黏土，山顶立一只统一的量杯。这一部分没人偷懒，因为喷发高度跟山顶的口径直接相关，杯口大了气跑得快，小了又容易从半腰胀裂。我们把杯口定在四厘米，用黏土把接缝全部封死，等它干透。

第一次正式测试，小苏打五勺，白醋半杯，喷发高度用直尺量，泡沫最高顶到杯口上方十一厘米。数据记在硬纸板上。问题跟着就来了：是醋越多喷得越高吗？第二次我们加到一杯醋，结果反而只有九厘米——醋倒得太满，把粉末压死了，气顶不动。第三次我们反过来减醋，四勺小苏打配小半杯醋，喷到十四厘米，而且喷得慢，前后持续了四十多秒。

那几天课间我们组四个人围着硬纸板吵。有人主张继续加小苏打，有人坚持先固定小苏打只调醋。最后定下的办法最笨也最稳：小苏打锁死五勺，醋从三十毫升起，每次加十毫升，各测一遍。注射器是医务室借的，直尺贴在模型侧面。测到第七组数据，曲线自己现出了形状：醋在七十毫升附近，喷发最高，二十八厘米；再多，高度往下掉。原来不是料越多越好，是两样东西要刚好赶上彼此。

科学节那天，台下坐着两百多人。我们按第七组的配比操作：五勺小苏打落进杯底，红色的醋沿着杯壁渗下去，滋滋声从杯底一路顶上来，泡沫冲出口沿，直尺上的白沫线爬到三十厘米才停。台下安静了一秒，然后鼓掌。主持人问我们凭什么跟去年那班不一样，组长把硬纸板举起来，上面是七组数据。

后来我把那块硬纸板留了下来。它提醒我一件事：喷出来，只是实验的开始；把喷出来这件事量清楚，才是科学探究的开始。动手的价值不在于手动了，而在于手动过之后，问题有没有跟着变清楚。

How Much Vinegar: We Measured It Three Times

On the science festival sign-up sheet, our group entered volcano eruption. When our homeroom teacher signed, she looked up for a moment: a class did this last year. What will you do differently? Our group leader said: we plan to measure the eruption. She handed the pen back and signed.

None of us can say exactly when the project stopped being a show for us and became a question. The difference is this: everyone else only needs the volcano to erupt. What we wanted to answer was how to make it erupt the highest and the longest.

And that question had no ready answer in the textbook. We could only find it ourselves.

The model followed the usual method: a newspaper frame, wrapped in tape, coated with clay, with a standard measuring cup set at the summit. Nobody slacked off on this part, because eruption height is tied directly to the mouth of the cup. Too wide and the gas escapes too fast; too narrow and the slope splits at the middle. We fixed the mouth at four centimeters and sealed every seam with clay, then let it dry through.

In the first formal test: five spoonfuls of baking soda, half a cup of vinegar, height measured with a ruler. The foam topped out eleven centimeters above the rim. We wrote the number on a piece of cardboard. The question came right with it: does more vinegar mean a higher eruption? The second time we used a full cup of vinegar, and the result was only nine centimeters. Too much vinegar pressed the powder flat, and the gas could not push. The third time we went the other way and cut the vinegar down: four spoonfuls of soda with a scant half cup of vinegar. It reached fourteen centimeters, and it erupted slowly, lasting over forty seconds.

For days we argued around that cardboard between classes. One of us wanted to keep adding baking soda; another insisted on fixing the soda and adjusting only the vinegar. The method we finally chose was the dumbest and the steadiest: lock the soda at five spoonfuls, start the vinegar at thirty milliliters, add ten milliliters each round, and test every combination once. We borrowed a syringe from the school clinic and taped a ruler to the side of the model. By the seventh set of data, the curve showed its shape on its own: near seventy milliliters of vinegar the eruption peaked at twenty-eight centimeters; past that, the height fell. It turned out more material is not better. The two have to arrive at each other at exactly the right moment.

On festival day, more than two hundred people sat below the stage. We followed the seventh set of proportions: five spoonfuls of baking soda fell into the cup, the red vinegar seeped down the inner wall, the hissing rose from the bottom all the way up, the foam shot over the rim, and the white line on the ruler climbed to thirty centimeters before it stopped. The audience went quiet for one second, then applauded. The host asked what made us different from last year's class. Our group leader held up the cardboard. On it were seven sets of data.

I kept that cardboard afterwards. It reminds me of one thing: an erupting volcano is only the beginning of the experiment; measuring what erupting means, that is where real scientific inquiry begins. The value of hands-on work is not that the hands moved. It is whether the question grew clearer after they did.