Cafe Tang: An Integrated Platform for Optimizing Lab Member Productivity, Happiness, and Budget

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ABSTRACT: Improving the lab environment is crucial to generating happy and productive PhD holders, who serve as the cogs in the scientific research machine. However, there is a lack of integrated methods to achieve such research lab improvements. We developed Cafe Tang as an integrated snack-vending platform that optimizes lab member outcomes (productivity, energy, and happiness) without imposing financial strain. We demonstrate Cafe Tang’s effectiveness through analysis of purchasing trends and surveys of lab member metrics. The described system offers a simple yet cost-effective strategy for research lab improvement in the digital age.

INTRODUCTION

Scientific research is generally regarded as beneficial to society.\(^1\) Among leaders who drive scientific research, the population is roughly equally divided among three major categories: (1) professors leading research labs in academia, (2) people who have earned their PhDs and are working in industry, and (3) Facebook group admins.\(^2\) Based on the first two groups, having a PhD is an important factor in leading scientific research. When considering where PhDs are harvested, a surprising finding was that 100% of PhDs are awarded to people who enrolled in a PhD program in graduate school and worked in an academic research setting (excluding honorary PhDs awarded to celebrities and influencers).\(^3,4\) Clearly, success in the academic research lab environment is directly responsible for and supports 2 of the 3 major categories of scientific research leaders (professors and industry PhD holders). Thus, there is a critical need to optimize methods to motivate lab members and increase productivity in the research lab environment.

Traditional methods to motivate lab members and increase productivity have, in recent years, been deemed cruel and unusual. For example, strategies such as making students cry during lab meetings or threatening that they will never do research again if they break the centrifuge were only able to increase productivity by 10% at the costly expense of nearly 100% of the lab member’s self-esteem.\(^5\) Modern methods have taken a more balanced approach to managing lab member morale as a means to improving productivity. After all, happy cows make happy milk.\(^6\) Towards improving lab member morale, recent studies have indicated that snack availability in close proximity to laboratory space is the single most important factor in increasing lab member happiness, outranking the next three highest metrics (a basic sense of self-respect, funding, and a belief that their research will have a positive impact on society) by as much as 70%.\(^7\)

Here, we present Cafe Tang, a novel platform for optimizing lab member productivity as a function of budget and energy. The platform is seamlessly integrated between a metaphysical space and a digital space, allowing efficient transfer of snacks to lab members in a cashless manner (i.e., without the need to fish for last night’s spare change) and without the need for human interactions (i.e., no awkward moments when the cashier says “Enjoy” and then you reply “You too”). We implemented Cafe Tang in a test group of lab members and measured the purchasing trends and correlated productivity. We also assessed the effectiveness of mainstream marketing strategies, such as streamlined menus, in increasing the performance of Cafe Tang and its test subjects. Overall, we found that our platform was able to boost lab member energy and productivity while minimizing costs for all parties.
METHODS
Food and drink acquisition
Cafe Snacks were sourced through Costco Wholesale locations in Redwood City, CA, and Mountain View, CA. Not all snacks are created equal, so the snack selection process was modeled as a Markov Chain to aid decision-making (Figure 1). Other considerations included the distribution of sweet vs. savory snacks and if a snack was currently on sale. Costco memberships were either purchased directly or attained by piggy-backing off of loved ones for personal gain.

Mainstream marketing strategies
Menus were designed in Microsoft Word (Microsoft Corporation, Redmond, WA). Humorous one-liners were generated by machine learning algorithms and used to describe each cafe menu item. Occasionally, the menu included combination deals that offered a bundle of multiple items at 10% discount from normal price.

Transactions
Menu items were priced at cost, rounded to the nearest $0.05, and were typically in the range of $0.20 to $0.50 per item. Transactions were performed using Venmo (New York, NY), a peer-to-peer payment system, by scanning a QR code located at the Cafe storefront with a smartphone device.

RESULTS
Construction of the Cafe Tang platform
The location and ecosystem of the lab was as follows. Space for the cafe was obtained as part of the
“Lab chores” initiative, which sought to clear the clutter in the lab. By the law of conservation of space, as more room in the lab became available, more mass spontaneously appeared to occupy it. Cafe supplies were thus able to be stored on the shelves of the Tang lab. Costco trips were made whenever we depleted our personal rations supply at home, especially when the new round of Costco Monthly Savings started. To take full advantage of the cost of gas, Cafe Tang supplies were bought at the same time.

The cafe menu was based on industry standards of cafe offerings including sweets, savory meal items, nostalgic classics (e.g., kindergarten snacks) and beverages, with at least one caffeinated option. Specific menu items were chosen based on several criteria, including anonymous polling, word of mouth, and eavesdropping on customer conversations. These criteria were fed into an advanced Markov chain model to aid in the decision process (Figure 1). Following purchase, menu items were placed in lab and a menu display was fabricated (Figure 2).

**Purchasing Trends and Productivity**

To understand the impact of Cafe Tang, we tracked purchasing trends through Venmo over a period of 295 days.

First, we examined the average sale by hour of the day (Figure 3). We found that the average sales per hour rapidly climbed from ~$0.00 in the early morning (08:00) to a peak of ~$0.20 around late afternoon (~17:00). The sale amount of ~$0.20 corresponded to ~1 typical menu item. Through the evening and late night/very early morning, the average sales gradually decreased, but remained consistently non-zero.

Next, we examined the average sale by day of the week (Figure 4). For most of the week from Tuesday through Friday, average sales per day were about $2.50, corresponding to ~7 menu items/day. Sales dropped during the weekend to about $1.00/day on Saturday and $0.50/day on Sunday, corresponding to ~3 and 1-2 menu items/day, respectively. Surprisingly, sales did not make a full recovery on Monday and remained low, ~$1.00.

Finally, we assessed productivity by the number of publications from the lab and by asking people how they were doing. In the years 2018-2020, the lab published 4-5 publications per year. In 2021, when Cafe Tang was implemented, the lab published 7 papers. As of 04/2022, with continued Cafe Tang presence, the lab is already at 4 publications. Further, before Cafe Tang was implemented, the typical response from a lab member when asked about their well-being was of the form “Okay I guess, but I wish we could go into the lab and do stuff. The pandemic is really frustrating”. After Cafe Tang was implemented, the typical response was of the form “Good. How about you?”. Therefore, we conclude that Cafe Tang boosted both productivity and happiness.
Effectiveness of Mainstream Marketing Strategies

The combo deal option was a very popular choice among lab members. User feedback often combined positive perceptions of the combo deal with negative perceptions of their own self-control. For example, lab members often expressed sentiments of not being able to resist a good deal and that now they just had to buy more. However, the decrease in happiness caused by realizing how little self-control they had was almost 10 times lower in magnitude compared to the increase in happiness caused by saving 30 whole cents through the combo deal.

DISCUSSION

Our design of Cafe Tang followed an evidence-based, structured approach that resulted in a balanced and budget-friendly menu. By tracking the purchasing trends, we uncovered distinct trends in lab member behavior. Lab member purchases peaked in afternoon hours (14:00 to 18:00), likely due to requiring sustenance to continue with experiments. Although purchases decreased towards the evening, there were still a non-zero amount of purchases made through the late night and early morning, indicating that there was still a non-trivial degree of productivity in the lab for almost the entire 24-hour cycle.

For the entire duration of Cafe Tang implementation and data collection, there were a total of zero purchases made during the period between 08:00 and 09:00. No other hour had zero sales for the entirety of the test period. This suggests the existence of a sacred 8 am lab Sabbath, where all lab work is paused, and lab members contemplate the meaning of this futile existence.

When we examined the average sales by day of the week, we observed a trend of generally high weekday sales and lower weekend sales. This result was consistent with lab members partaking in their hobbies during the weekend, which commonly include playing tennis and not answering Slack messages. Surprisingly, Monday sales were as low as the weekend sales, possibly due to lab members shaking off the effects of...
the weekend binge and preferring fried food from The Axe and Palm over healthier options at Cafe Tang.

Our results suggest that Cafe Tang boosted productivity, as measured by the number of publications per year produced by the lab. However, the use of performance-enhancing Red Bulls may be a confounding factor. Unfortunately, it is experimentally difficult to circumvent this issue, as providing some sort of caffeine is a necessary component of the Cafe Tang design.

The pay-at-cost and digital format of Cafe Tang were major improvements from previous in-house lab snack bar models. Models that split snack costs equally and are free-for-all to grab require trust that no one takes more than their fair share. Models that are cash-only often result in forgotten IOU’s as lab members do not always carry cash. Often, these previous models devolve into a tragedy of the commons in a stunning display of the failures of communism.

Finally, we found that mainstream marketing strategies improved the reception of the Cafe Tang system. Combo deals and engaging menu descriptions encouraged lab members to increase their purchases. Although there are clear benefits to lab member happiness and productivity, there is a potential risk of adverse side effects from using Cafe Tang. Further study is needed to investigate the long-term effects of addiction to cheap and convenient methods of acquiring sustenance.

CONCLUSION
Here we have demonstrated the Cafe Tang system, a novel platform for increasing lab member productivity and happiness. Using budget-friendly and health-oriented snacks, digital payment tools, and mainstream marketing strategies, Cafe Tang is an effective method to dramatically improve the quality of life in any research lab environment.

ETHICS DECLARATIONS
As of 2022 under the United Nations Charter, lab rats are classified as a lesser life form than actual rats. IRB review and consent for data collection and usage was not required.

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REFERENCES