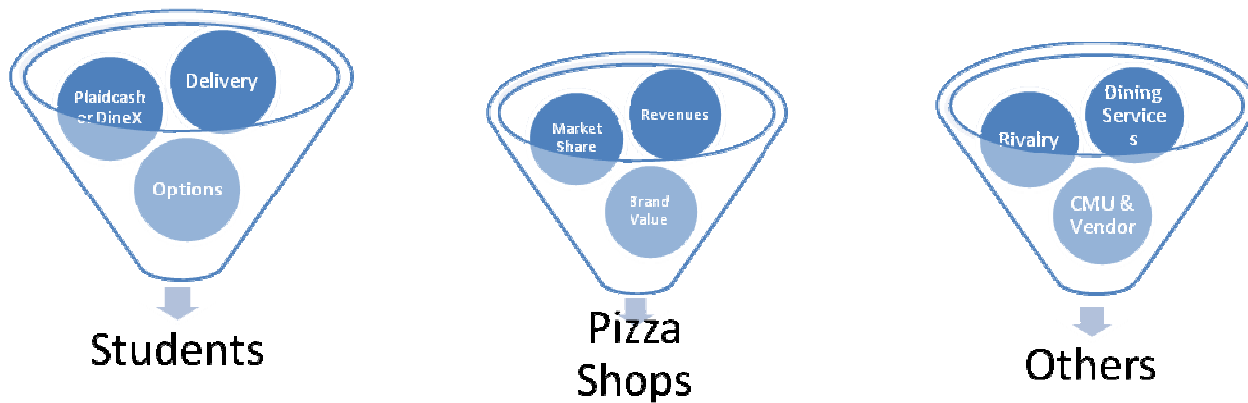


Introduction

The overarching question that this project focuses on is primarily: “What characteristics of pizzas and pizza shops appeal to the undergraduate students enrolled in the Pittsburgh campus of Carnegie Mellon University?” By conducting a straightforward stakeholder analysis we can understand the motivation behind this project. Three categories of stakeholders are shown below, namely the students, pizza shops and an others category that mixes a couple of options.



The above question is interesting due to its relevance to a large number of consumers on CMU's campus. College students in particular would find the results intriguing for several reasons: first, pizza is a traditionally heavy part of their cuisine, and second, many of them are non-local and thus unfamiliar with the wide selection of local pizza restaurants. Our research question could potentially enable us to find some interesting outcomes that we can integrate with CMU's dining plan by suggesting an on campus dining location or allowing students to use dineX or Plaidcash to make it more convenient. This proposal is also doable as we have access to all students through various modes (described later) on campus. Creating flexibility in the dining system either by adding an extra option with a delivery capability or just by being able to serve at later hours pizza shops will certainly be popular in a place like Carnegie Mellon University.

Moreover there are a tremendous number of pizza options in Pittsburgh and it is interesting to study why certain pizza places do better than the others and why certain pizza choices are popular among students. As an additional side effect, the survey could benefit small, high-quality pizza places that don't have the name brand to compete with recognized national chains. Pizza shops can clearly benefit from the results from our study by reorganizing to capture a greater market share, increase market value in order to gain long term revenues.

The third bracket of stakeholders includes a mix of options. Firstly, local food vendors, the trucks, hot dog stand, Tartan's Pavilion and so on will want to understand why the off campus pizza options might be more popular. The Dining services and CMU might finally want to add another pizza option on to the campus system after this study, and hence the statistical analyses and survey data will be essential in building their case. As expected we are seeing a large response rate, as this topic is very popular amongst students. This project has great applicability and potential in the local area and we are excited to present the results!

Citations to Literature on This Topic

The following are the list of a few sources that we have been researching. Some of the sources below present current literature and research on the topic and after looking at it thoroughly we have provided ways in which the results can be used in our project:

- a) The Zagat Survey is naturally very relevant to our plans for a survey ranking pizza restaurants. We checked out how the survey works; it displays a comprehensive list of restaurants and allows the respondent to vote on any number of them, giving any restaurant a 4-point 'score' for food/decor/service. It allows respondents to enter optional information about price and a free-form "comments" field, while offering a large reward for "witty" and quote-worthy comments. These optional fields are likely used as additional information when Zagat releases their retail restaurant guides, rather than in the comparative ranking of restaurants. The criteria that Zagat uses to rank restaurants are interesting and we should consider it for our own survey, but perhaps decor is not as important in our case, considering that pizza is often delivered.
- b) <http://www.rateitall.com/t-10945-pittsburgh-pizza.aspx> The following article presents some reviews of the pizza places in Pittsburgh, while the survey result helps us in understanding what some of the better questions are and the relationship between the survey responses and how the questions are phrased.
- c) http://www.yelp.com/search?find_desc=Pizza&ns=1&find_loc=Pittsburgh%2C+PA This data will be interesting for a variety of reasons. There are many pizza places in Pittsburgh that specialize in different types of pizza. It would be interesting to find out what types of pizza most like, whether they are very loyal to one pizza parlor, what size pizza they usually order, etc. The survey's results could potentially show us the most popular pizza type in Pittsburgh. This website is more of a collection of community reviews than a full fledged survey or study. However, it is a collection of random people rating different pizza restaurants in the Pittsburgh area and should provide us with a good baseline for our survey
- d) <http://community.post-gazette.com/blogs/citywalkabout/archive/2009/02/25/this-just-in-east-end-pizza-survey-s-top-vote-getters-revealed.aspx> This is an interesting link to the Pittsburgh post gazette that has a few theories on how surveys are done, who the prime voters are, and what the rankings are. This survey also has some reviews on what determines good pizzas or good brands.
- e) **Title: Program of mini surveys: pizza survey.** This journal was written by the food standard agency in UK and presents its results. We can learn dietary facts about various popular pizza locations and how it would have an impact on survey results.

Quick Summary of Main Results

- 54% of our respondents were male and 46% were female
- Of our respondents 30% were Freshmen, 23% Sophomore, 29% Juniors and 18% Seniors
- Price and Quality seem to dominate the factors that influence pizza consumption (33%, 30%)
- Pizza prices do have a “somewhat” impact on pizza consumption and the proximity of pizza locations “doesn’t really matter”.
- Currently at 26% response rate

Methods

The population that we will sample is clearly the *sampling frame*. Ideally we would like to sample our entire target population but due to several reasons (lack of access, etc) we may not be able to survey our entire anticipated target population. The sampling frame includes the chunk of the target population that we have access to and are in the scope of the people we would like to sample. Thus our sampling frame includes those Carnegie Mellon University undergraduate students from the Pittsburgh campus who are listed in the online CMU student directory.

We want to make inferences about our *target population*. The target population includes *all undergraduate students who are currently freshman, sophomores, juniors and seniors studying in Carnegie Mellon University's main campus in Pittsburgh*. Freshmen, who are on the dining plan, will also be surveyed to understand what proportion of them actually order pizzas from off campus. It will be interesting to see these results, since by understanding what pizza locations and pizza choices are preferred- we can then incorporate it in to the dining plan and make it useful for future freshmen students as well. Freshmen are not a central part of our study, but on collecting a data on them we can stratify based on year and draw further conclusions on freshmen. We are also keen to make inferences about several sub groups of our target population. For instance: how does the most popular pizza choice or the reasons for dissatisfaction vary with race or major? We feel that this might reveal some interesting results.

In order to achieve a margin of error that was about 6.8%, we needed a sample size of 211 people. Since our survey was going out via e-mail, we were also estimating an approximate 30% response rate. This meant that we needed to contact 650 people in order to ensure we reached our desired sample size.

The sampling was conducted in the following manner:

1. A custom Ruby script was created that enabled us to download the Andrew IDs for every undergraduate that resides on the Pittsburgh campus. These Andrew IDs were randomly sampled. 800 Andrew IDs were sampled and stored in a list. The Andrew IDs were checked to ensure none of them were the Andrew IDs of the researchers.
2. Each Andrew ID in the sample was loaded and hashed with a SHA-1 hash. This hash enables each individual Andrew ID to be mapped to a unique ID but also allows us to go back later to recontact. However, since this mapping always happens within software, the researchers themselves do not ever know which SHA-1 hash maps to an Andrew ID.
3. Once a SHA-1 hash had been calculated, each Andrew ID was emailed with a custom link to the survey.
4. Upon the need to recontact, the list of SHA-1 hashes that have answered will be read in. Within software, each Andrew ID in the sample will have its SHA-1 hash recalculated. If that SHA-1 has already taken the survey, it will not be recontacted.

This methodology was not, however, without a small problem. CMU does not clean out their student directory for some past alumni. This meant that a handful of those in the sample an Andrew ID that did not correctly receive e-mail. To compensate for these problems, the population was resampled for each occurrence until a new, suitable Andrew ID was obtained (ie one that received e-mail and was not already sampled).

From the 800 Carnegie Mellon undergraduates at the Pittsburgh campus, we have received 189 respondents as of Sunday, 11pm.

Presented here are some sample questions from our survey. These questions disclose the strategies to gain consumer information. The first question involves finding out what time pizzas are approximately ordered. If the major set of responses are in the “odd hours” category (11pm-10am), then we can be sure that there is huge potential for the pizza places to get on campus, since there are not a lot of options available at late hours at night- especially that do delivery. The second question aims at understanding what percentage of the undergraduates in our sampling frame eat frequently on campus, and if so, how frequently. Furthermore, we are interested in how often upperclassmen eat on the golf course. More questions are presented in the appendix, and now we shall move on to some of the results we got from our survey.

Sample Questions

Question: What time of day do you typically order pizza? Mark all that apply.

4:00 a.m. – 10:00 a.m.

10:00 a.m. – 2:00 p.m.

2:00 p.m. – 6:00 p.m.

6:00 p.m. – 11:00 p.m.

11:00 p.m. – 4:00 a.m.

Question: How many times per week do you eat food from a campus dining restaurant (Entropy, trucks, hot dog stand, all other dining locations included)?

0

1-2

3-5

6-10

10-15

15+

Post-survey Adjustments

After respondents provide data to ensure that the quality of our estimates are high we may need to make post survey adjustments, which include weighting underrepresented populations or imputing missing values in the surveys.

If the stratified sample is not representative of the target population, we will use our program to randomly select an additional sample from underrepresented strata that will produce enough expected respondents to make our overall sample reflective of the target population. We will then send out surveys and follow up on the new sample using the same methods we applied to the original sample. If there is inadequate time to complete an additional sample, then we will use a simple weighted approach for the existing answers, putting more weight on the underrepresented strata.

Demographics

Of the 189 respondents, 102 were male and 87 were female. The breakdown of the respondents’ class is show in Table 1, with freshmen and juniors being the majority. Also, Table 2 shows the breakdown of the colleges that the responding students were in, and it is obvious that students in CIT contribute the most to the make-up of the sample. We will need to incorporate post-stratification weights after the survey collection is cut off if these data show that our sample is not representative of our target population.

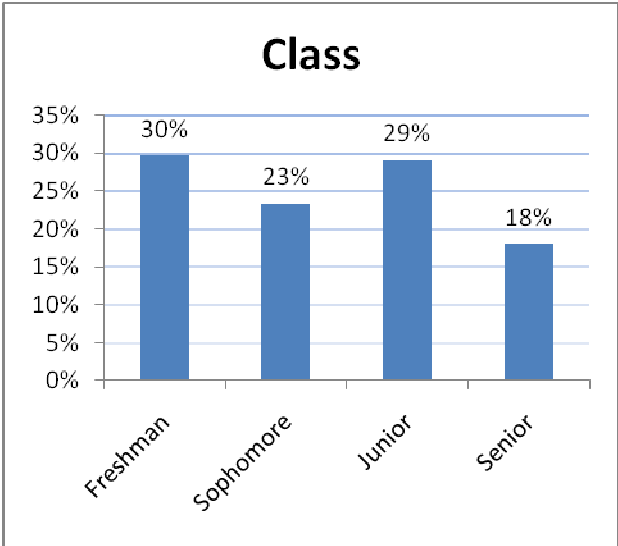


Table 1: Breakdown of Respondent’s Class

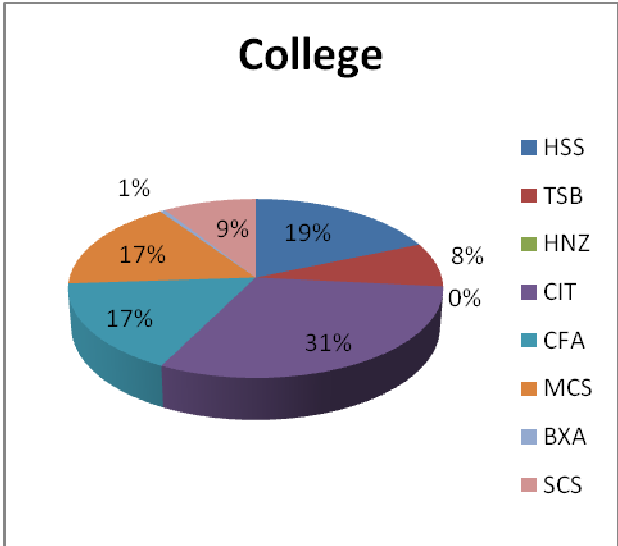


Table 2: Breakdown of Respondent’s Colleges

Research Variables

The main research question that this project aims to answer is: “What characteristics of pizzas and pizza shops appeal to the undergraduate students enrolled in the Pittsburgh campus of Carnegie

Mellon University?” In order to answer this question, 17 survey items focused on pizza consumption and preference of students at Carnegie Mellon University.

Once such question asked what factor influences the subject the most when he or she orders pizza. The respondents’ results are shown in Table 3. It is surprising that “Quantity” is the most influential factor in pizza consumption among college students as one would easily make the mistake of assuming that college students are more worried about the quantity of the pizza, rather than the quality. We do see, however, the price and quality of the pizza affecting pizza consumption. Particularly, price plays a huge role in pizza consumption as many of the answers in the “Other” category were about the options of being able to use Plaidcash or DineX.

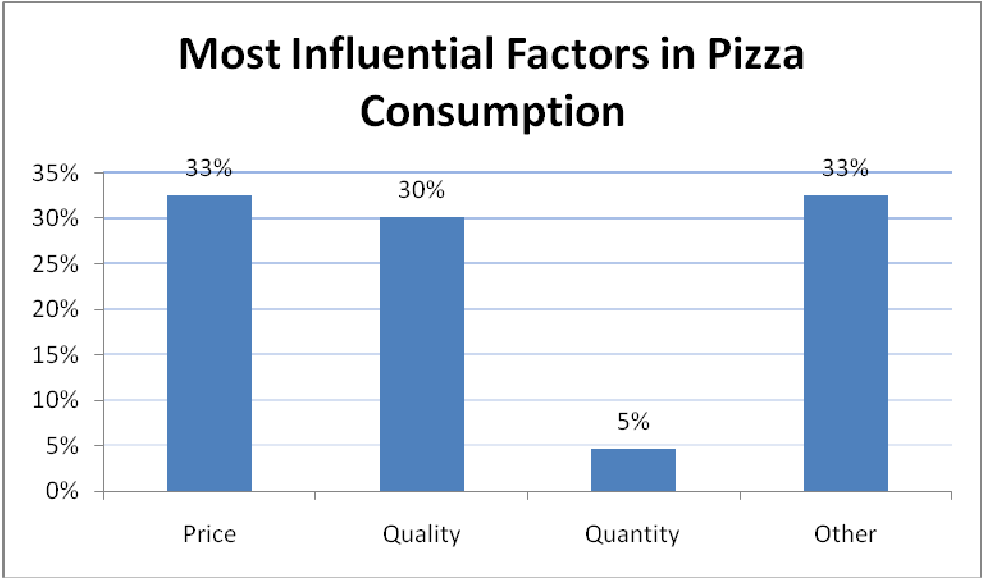


Table 5: Most influential Factors in Pizza Consumption

Respondents were also asked how much effect the pizzeria’s prices and the pizzeria’s proximity have on their pizza consumption, and how important it is to them that the pizza is delivered or served hot, and that the pizza ingredients are fresh. Table 4 and 5 show the responses to the effect of pizzeria’s price and proximity, and it is clear that the prices affect the students’ consumption of pizza more than the pizzeria’s proximity, again manifesting the strong effect of prices on students. Table 6 and 7 show that the importance of the pizza ingredient’s freshness is a bit less important to the respondents than that the pizza is served hot, as 97% of the respondents said that it is important or somewhat important that the pizza is served or delivered hot.

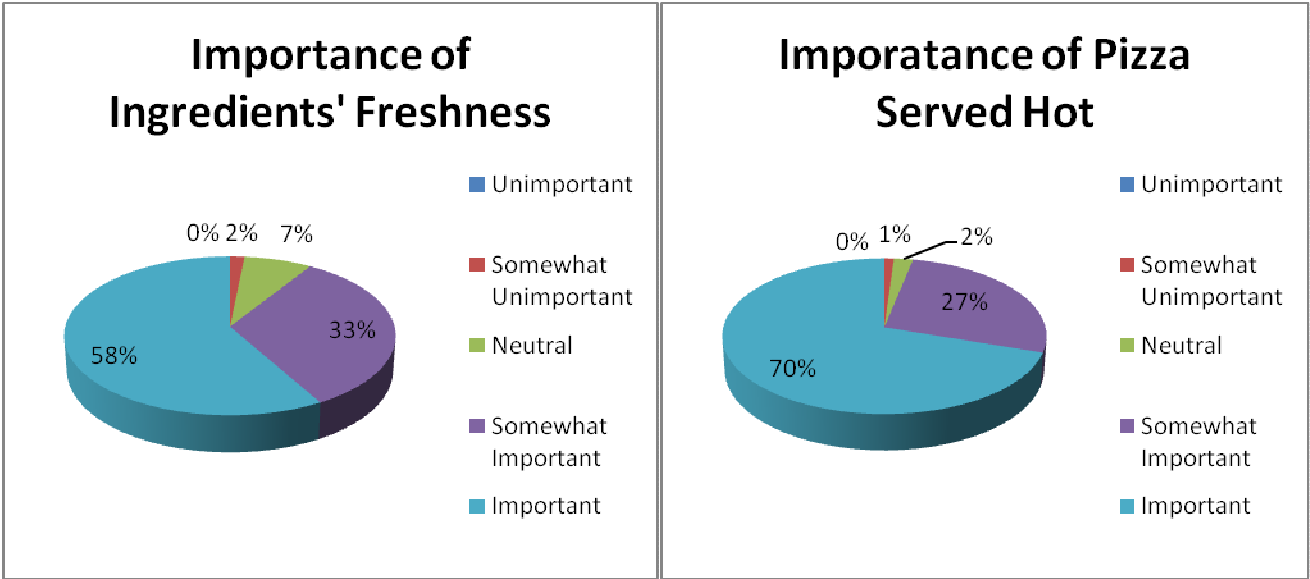


Table 6: Importance of Ingredient’s Freshne

Table 7: Importance of Pizza Served Hot

When the survey collection is finished, the researchers will use the responses to create regressions and meaningful findings on pizza consumption and preferences of undergraduate students at Carnegie Mellon University.

Discussion

Overall there was a good amount of information that we have received from the first round of surveys. The aspects that we were interested about were the consumer side and the producer side. An interesting point to note was the speed with which we got our response rate. The demographic results were interesting to note; we had a roughly representative sample for gender and the same for the year of students as undergraduates. In terms of the distribution and split up by college we noticed that 31% of or respondents are from CIT, which is the leading majority. At the same time, we noted that response rates from certain colleges were low/almost 0.

In terms of more consumer related questions a takeaway was that price and quality (33%, 30%) were the biggest factors that affected consumption. Price is an expected variable for this category, but we were surprised to see that quality came before quantity-just based of the fact that a people often eat pizza cold in colleges. 58% percent of the people felt that the freshness of ingredients is important in their pizzas, and we also learned that 70% of the people find it important to eat warm pizza.

We have got a greater insight in to these questions as well, and we shall carry out further statistical analyses and derive more results after making our post-survey adjustments.

- ❖ Determine how often people eat pizza and order for delivery, and where their favorite pizza place is

- ❖ Compare the quality of pizza in chains to that of smaller, local places and what gives rise to this difference in quality
- ❖ Examine each aspect of a pizza shop (pizza quality, non-pizza products, cost, business hours, delivery) and the influence of each on where one chooses to order from

These are questions that address the important and central concepts of our project. Hence we gained significant information from our surveys and the next round of information should provide not only our results but also the conclusions that we reach from them.

The strength in our survey lies in the ease with which we disseminated our surveys and doing so we still had a full record of who all we sent it to. Computer algorithmic methods used helped us reach out quicker to a larger sample frame. We feel that the questions that we have included in our questionnaire have been given significant thought and we have also taken significant feedback in order to ask questions that would give the *right* answers (without bias and so on). As of now, the survey that we sent out asks a lot of qualitative questions. Yes, we can number certain categories and give a scale form of rating to run regressions and gain more statistical insight in to our data. However, we feel that converting ratings like somewhat, important, not important converted to a 1-5 scale by us will be different than from what the respondents would have filled out (minor bias).

Based on the responses we have got thus far as well as the speed at which we have got these responses we have reason to believe that the topic of our survey is very relevant to the undergraduate students at Carnegie Mellon University. We are still in the process of compiling all our data and coming up with solid conclusive results. As for now, the focus is to send out the second round of mail requests to get the required sample number of respondents. After that we need to make our post-survey adjustments and then synthesize our results.

List of References

1. **Title: Program of mini surveys: pizza survey**
2. <http://www.rateitall.com/t-10945-pittsburgh-pizza.aspx>
3. <http://community.post-gazette.com/blogs/citywalkabout/archive/2009/02/25/this-just-in-east-end-pizza-survey-s-top-vote-getters-revealed.aspx>

Appendices

Questionnaire

1. What is your age? _____
2. What is your gender?
 - a. Male
 - b. Female
3. What is your year in school?
 - a. Freshman
 - b. Sophomore
 - c. Junior
 - d. Senior
4. What is your primary school?
 - a. CIT
 - b. CFA
 - c. HSS
 - d. TSB
 - e. MCS
 - f. SCS
 - g. Heinz
 - h. Other: _____
5. What is your home state or country? _____
6. How many times per week do you eat food from a campus dining restaurant (Entropy, trucks, hot dog stand, all other dining locations included)?
 - a. 0
 - b. 1-2
 - c. 3-5
 - d. 6-10
 - e. 10-15
 - f. 15+
7. How often do you eat pizza?

- a. Daily
 - b. Weekly
 - c. Monthly
 - d. Annually
 - e. Never
8. What kind of pizza do you like the most?
- a. Thin crust
 - b. Thick crust
 - c. Deep dish
 - d. Sicilian
 - e. Other: _____
9. What methods do you use to order pizza?
- a. Internet
 - b. Telephone
 - c. Text
 - d. Walk-In Order
 - e. Other: _____
10. When you order pizza, what factor influences your order the most?
- a. Price
 - b. Quantity
 - c. Quality
 - d. Other: _____
11. When you order pizza, how often do you order from the same pizzeria?
- a. Always
 - b. Often
 - c. Sometimes
 - d. Occasionally
 - e. Never
12. How much does the proximity of a pizzeria affect your decision to order from it?
- a. Completely
 - b. Somewhat
 - c. Neutral
 - d. Doesn't really
 - e. None
13. What delivery time is acceptable to you?
- a. Less than 15 minutes
 - b. 15-30 minutes
 - c. 30-45 minutes
 - d. 45-60 minutes
 - e. More than 1 hour (don't really care as long as it comes)

14. How much does the price of the pizzeria affect your decision to order from it?
- a. Completely
 - b. Somewhat
 - c. Neutral
 - d. Doesn't really
 - e. None
15. How much does the occasion for eating the pizza (ie just for dinner, for a party, etc) affect your decision on what pizzeria to order from?
- a. Completely
 - b. Somewhat
 - c. Neutral
 - d. Doesn't really
 - e. None
16. What time of day do you typically order pizza? Mark all that apply.
- a. 4:00 a.m. – 10:00 a.m.
 - b. 10:00 a.m. – 2:00 p.m.
 - c. 2:00 p.m. – 6:00 p.m.
 - d. 6:00 p.m. – 11:00 p.m.
 - e. 11:00 p.m. – 4:00 a.m.
17. How much do business hours affect your decision to order from a pizzeria?
- a. Completely
 - b. Somewhat
 - c. Neutral
 - d. Doesn't really
 - e. None
18. On what day of the week do you typically order pizza? Mark all that apply.
- a. Monday
 - b. Tuesday
 - c. Wednesday
 - d. Thursday
 - e. Friday
 - f. Saturday
 - g. Sunday
19. How do you typically pay for pizza?
- a. Cash
 - b. Check
 - c. Credit Card
 - d. Dinex
 - e. PlaidCa\$h
20. How many of each size pizza do you typically order in one order?

- a. Small:

- b. Medium:

- c. Large:

- d. Extra Large:

- e. Extra Extra Large:

21. Which pizzeria do you feel is the best in Pittsburgh (including on campus dining)?

a. Vocelli’s

b. Papa John’s

c. Domino’s

d. Pizza Palermo

e. Tartan’s Pavillion

f. Antoons

g. Mineos

h. Lucci’s

i. Other: _____
22. Do you care that your pizza comes hot when delivered?

a. Yes

b. No
23. If yes, on a scale from 1-10 rate how important it is to get hot pizza
24. _____

From the following criteria: Freshness of ingredients, generosity with sauce/toppings, presentation, crust thickness, arrives hot, please list in ascending order in the order of importance.



Template for Online Consent

This survey is part of a research study conducted by a group of students supervised by Brian Junker at Carnegie Mellon University.

The purpose of the research is to ascertain how CMU undergrads consume pizza. This information is of potential use to area pizzerias since they could target their specials, business hours, etc. to maximize their business based upon how the results of this consumer study.

Procedures

Participants will be asked to complete an online survey. This survey is approximately 20 questions in length and should take no more than 15 minutes.

Participant Requirements

Participation in this study is limited to individuals age 18 and older.

Risks

The risks and discomfort associated with participation in this study are no greater than those ordinarily encountered in daily life or during other online activities. Although participants will not be asked incredibly sensitive questions, their responses will be stored by SurveyMonkey rather than the investigators, and thus we cannot guarantee against the very slim risk of data theft.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to local restaurants, who may choose to tailor their services to better accommodate the pizza consumption patterns discovered in the study.

Compensation & Costs

Upon completion of the survey, you will be entered into a raffle for a \$25 Amazon gift certificate.

There will be no cost to you if you participate in this study.

Confidentiality

The data captured for the research does not include any personally identifiable information about you, with the sole exception of your IP address, which is captured by SurveyMonkey for their administrative purposes only and not associated with your responses in any way.

By participating in this research, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data and other personally identifiable information as required by law, regulation, subpoena or court order. Otherwise, your confidentiality will be maintained in the following manner:

Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

Right to Ask Questions & Contact Information

If you have any questions about this study, you should feel free to ask them by contacting the Principal Investigator now at:

Brian Junker, Department of Statistics

132E Baker Hall

Carnegie Mellon University

Pittsburgh, PA 15213

(412) 268-2718

brian@stat.cmu.edu

If you have questions later, desire additional information, or wish to withdraw your participation please contact the Principle Investigator by mail, phone or e-mail in accordance with the contact information listed above.

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact the Research Regulatory Compliance Office at Carnegie Mellon University. Email: irb-review@andrew.cmu.edu . Phone: 412-268-1901 or 412-268-5460.

The Carnegie Mellon University Institutional Review Board (IRB) has approved the use of human participants for this study.

Voluntary Participation

Your participation in this research is voluntary. You may discontinue participation at any time during the research activity.

I am age 18 or older. ☐ Yes ☐ No

I have read and understand the information above. ☐ Yes ☐ No

I want to participate in this research and continue with the survey. ☐ Yes ☐ No
