Name:	Kurt Friehauf	Student ID #:	1123581321
Local Address:	123 Tin Pan Alley, Kutztown, Colorado 80555		
Local Telephone:	555-123-4567	Email:	friehauf@kutztown.edu
Major:	Geology	Credit hours this semester:	16
Expected graduation date:	May 2026	Total credit hours at KU:	110
Research faculty advisor name:	Dr. Jennifer Forsyth	Faculty email:	forsyth@kutztown.edu
Title of Research Project:	Geophysical Estimation of Jarred Jellybean Abundance		
Total Project cost:	220	Costs covered by other sources:	0
Funding type requested:	☑ Research materials ☐ Travel to present research ☐ Travel to do new research	Destination (if travel):	n/a
Have you received a previous research grant from the KURF?	☑ Yes No	If yes, date of grant:	February 2015
Title and amount of previous KURF research grant received:	Estimating Lima Bean Abundance - $250		
If Institutional Review Board (IRB) approval of the ethical treatment of subjects is required for project, date application submitted to IRB or date received IRB approval for research: *Include explanation in proposal*	☑ submitted approved date: 08/2024		
If Institutional Animal Care and Use Committee (IACUC) approval of the ethical treatment of subjects is required for project, date application submitted to IACUC or date received IACUC approval for research: *Include explanation in proposal*	☐ submitted approved date:		

Project title: Geophysical Estimation of Jarred Jellybean Abundance

Student name: Kurt Friehauf

Faculty advisor: Dr. Jennifer Forsyth

Program: Geology

Project cost: $220

Commented [KF1]: Probably not the best category for this proposal, but this is just an example and Geology is my field.

Abstract

Stimulation of student academic performance can be achieved by providing sugary foodstuffs to increase blood glucose levels in the brain. Accurately assessing the quantity of jellybeans that will service a given student population requires both an understanding of the biological sugar needs of students (e.g., Forsyth and Friehauf 2023a), and a precise estimation of the number of jellybeans in a given storage jar. Jellybean abundance estimates may also alert faculty to the potential need to replenish supplies before complete depletion and the onset of student hypoglycemia. We propose to estimate the number of jellybeans in pickle jars using a combination of gravimetric and acoustic methods. The methods proposed here will also identify potential non-linearities in relationships between jellybean count and acoustic properties.

Commented [KF2]: Abstracts are concise summaries of the contents of a paper or proposal. They should contain sufficient content to give the reader a good understanding of your question, observations, and conclusions.

- Many people will read your title.
- Of those who read your title, only a small fraction will read your abstract.
- Of those who read your abstract, only a fraction will look at your figures and captions.
- Of those who look at your figures and captions, only a small fraction will read your full paper text.

Write your abstract with the assumption that it is the only thing your reader will read.

Introduction

Increasing the amount and quality of undergraduate student schoolwork output is perhaps one of the most important branches of professorial research today. The economic impacts of such research include, but are not limited to, increases in the supply of well-trained geologists to the workforce and the resulting direct increase in national gross domestic product (GDP), and a reduction in tax burden in the state due to higher professor retention (related to greater job satisfaction when professors see students working harder and more smartly). Developing methods for optimizing student output in relatively small (n < 25 students) geology classes at Kutztown University has potential application in programs with larger student populations if the methods are scalable.

Commented [KF3]: States examples of practical value to this research. How will humanity and/or the environment benefit from understanding the results of this research? This example states simple economic impacts, but other types of studies may produce key steps in developing new technologies, lead to better management of natural resources and diminished negative impacts on the environment, etc. (i.e., it's not always just about money)

Commented [KF4]: Connects the outcomes of this small study to the bigger picture of student groups in other programs/majors globally. We study small, narrowly-defined, tightly-controlled systems in order to understand the variables that drive the behaviors of more generalized systems everywhere.

Early workers focused on blunt-force approaches in which students were tyrannically burdened with large numbers of complex structural geology problems and geologic mapping projects (Erslev, 1987, 1988, 1989), massive exercises in memorization of mineralogical trivia (McCallum, 1985, 1986, 1988, 1989), and logging of drill cuttings, preparation of fluid inclusion samples, and basic rock descriptions (Thompson, 1987, 1988, 1989a, 1989b). Such primitive methods were sufficient for unusually motivated students, but a majority of students reacted to this approach by triaging assignments based on their potential point impact on course grades as a means of moderating stress and depressed blood glucose levels that power the brain (Grademonger, 2014).

Commented [KF5]: Establishes background context of the project. Most research is based on earlier research. This section demonstrates you are aware of past work and so you can build on it rather than re-inventing the wheel. It is also a respectful acknowledgement of the intelligence and efforts of others.

Self-administration of large doses of caffeine in the form of coffee or soda pop have historically driven up student output, but excessive quantities can have the negative side effects of hyperactivity (Tindall, 2010) and strong urinary urges (Friehauf, 2024). Furthermore, long-term studies by Forsyth and Friehauf (2023b) indicate prolonged use of caffeine results in pointless chemical addiction without significant stimulative benefits.

Commented [KF6]: References to past work by the authors of the proposal supplement the case that the authors are expert and capable of doing the proposed research. A thorough understanding of the past works of others also supports this characterization.

Consumption of carbohydrate-rich sweets and subsequent conversion of complex sugars to blood glucose is known and significant source of energy for student activities, including athletics, playing bagpipe music, and competitive crafting (Oakley et al., 2015). Heavy thinking requires brain combustion of glucose, so a constant feed of high-grade brain fuel can promote student learning.

In addition to the Brownian motion effects of hyperstimulation studied by Tindall (2010), excessive sugar consumption can also lead to the consumer gaining unwanted weight (e.g., Friehauf, unpublished self-study, 2014) which can degrade performance. Avoiding this hyper-carbohydrate drawback places an upper limit on wise amounts of stimulating sugar compounds per student, thereby placing a *lower* constraint on the number of students who can be stimulated by a specific amount of sugary foodstuff, assuming all students are administered stimulating sugar compounds. The *upper* constraint on the number of students affectable depends on the minimum dose of sugar necessary to produce the desired increased in activity. The number of sugar-stimulated students is therefore bracketed on both ends and depends on the total amount of sugary foodstuff available for distribution.

Dr. Forsyth maintains a large pickle jar of jellybeans in her classroom for stimulating students. Knowing the precise number of jellybeans in the jar enables her to estimate a bracketed total potential for student performance augmentation. Counting beans, however, is the domain of the accounting department, so an efficient method of estimating the number of beans is needed for day-to-day operations in her class. This study proposes to develop non-counting methods of estimating the number of jellybeans contained in pickle jars of any size based on mass and acoustic properties.

Problem statement

With what precision can the number of standard-size jellybeans at standard temperature and pressure in a 3.79-liter (1 gallon) pickle jar be estimated using gravimetric and acoustic analysis?

Methods

We propose estimating the number of jellybeans based on their mass and acoustic properties. The results of two separate techniques based on different principles will help act as an internal check for accuracy. Although the gravimetric method has the advantage of higher precision, acoustic analysis is both louder and more rhythmic.

Gravimetry

Each standard jellybean in the jar has a specific mass with a narrow variance centered on an industry standard. Although individual jellybeans differ slightly in mass, an average mass can be determined by weighing several jellybeans at once and dividing by the number of jellybeans according to equation 1:

$$m_{avg} = \frac{m_{samp}}{n} \qquad \text{(eq. 1)}$$

where m_{avg} is the average mass of an individual jellybean, and m_{samp} is the total mass of a sample of n jellybeans. Weighing a portion of the jellybeans and calculating the per-unit

Commented [KF7]: Note how references to papers with three or more authors indicate the name of the first author, then et al. (means *et alia* = Latin for "and others") rather than listing all authors.

Commented [KF8]: This introduction followed the pattern of:
1)Past work explaining context and prior workers use of other methods.
2)Past work relating the stimulus-response for this system.
3)Explanation of the relevance of the variable this study will test in such a way that the explanation segues to the last paragraph in this section which is a:
4)Statement of the conditions that inspired the question. This in turn segues to the specific problem statement in the next section.

Commented [KF9]: Try to be very precise in your wording of your research question. By very carefully stating exactly what you hope to determine, you set boundaries that will help keep your work focused and on-track, prevent mission creep that saps your resources, and clearly define the end of the project. Time spent carefully targeting your research goals now will save you orders of magnitude of time drifting later.

Commented [KF10]: Some branches of science scorn the use of first-person pronouns because such pronouns imply a degree of subjectivity of the study due to researcher observational biases. Other branches of science accept that scientific studies are executed by human scientists, none of whom are immune to bias, so they accept the use of first-person pronouns when this simplifies the language of the paper and increases readability.
Routine use of passive voice grammatical constructions is also accepted by some fields, and very strongly discouraged by others.
Please check with your research advisor to verify which standard your field prefers.

Commented [KF11]: The use of subheadings helps clarify the organization of a proposal or manuscript. Consider using subheadings when appropriate.

mass will allow for calculation of the total number of jellybeans using equation 2:

$$n = \frac{m_{total} - m_{jar}}{m_{avg}} \qquad \text{(eq. 2)}$$

where m_{total} and m_{jar} represent the total mass of the jellybean-filled jar and the mass of the glass jar *sans* jellybeans, respectively (Figure 1).

We propose using the balances available in the Friehauf Petrology and Geochemistry Lab at Kutztown University to measure the masses of jars, individual jellybeans, and composites of jars containing multiple jellybeans.

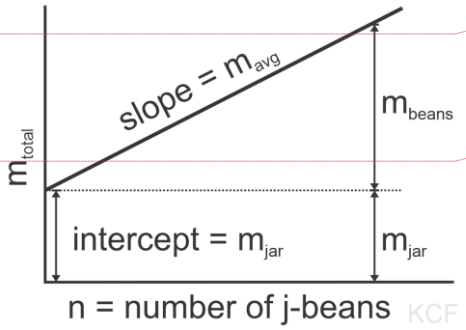

Figure 1. Graphic representation between total mass of sample (m_{tot}), mass of jar (m_{jar}), and mass of jellybeans (m_{avg} and m_{beans}).

Commented [KF12]: Reference each and every figure in your proposal. Figures are not hollow eye candy. Figures are included to increase the effectiveness of your communication. Failure to communicate results in proposal rejection.

Commented [KF13]: This documents that the instrumentation proposed for analysis in this proposal is available to the researcher. It is important to document this availability because proposals for research using inaccessible instrumentation will not succeed, and granting agencies only want to fund possible projects, not impossible projects.

Acoustic analysis

The method of acoustic analysis is founded on the principle that, when agitated, a partially-filled jar of jellybeans will make a sound fingerprint reflecting its state of fullness due to bean-jar and bean-bean collisions. Jars filled with only a few jellybeans produce a high pitched "tink – tink" or "tockle-tockle" sound when shaken. Due to grain-grain interactions and the distribution of collisional stresses between particles, large numbers of jellybeans produce a lower-pitched "schuckle-schuck-schuckle" sound when energetically agitated.

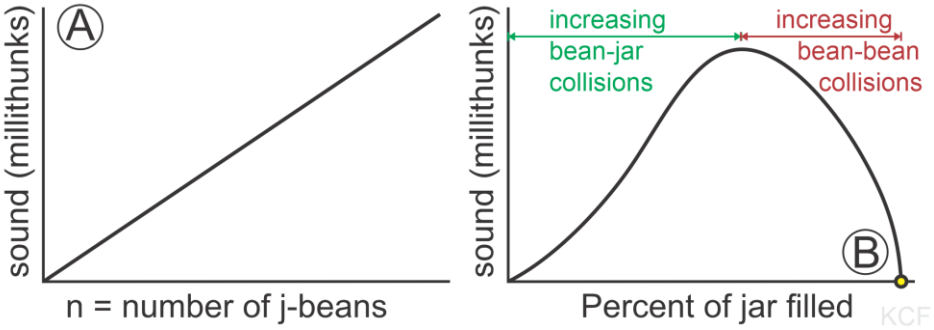

Figure 2. A. Hypothetical linear relationship between number of beans in the jar and sound based on the intuitive concept that more beans make more collisions, making more sound.
B. Hypothetical non-linear relationship between bean count and sound which considers reduced mobility of jellybeans as the jar becomes fuller. Yellow dot indicates point at which jar is too tightly packed to generate sound. Models based on this work.

This study will quantify the acoustic output of several different pickle jars, each variably-filled with multiple standard jellybeans ranging from 0% full to 100% full, using the standard digital acoustimeter in the Oakley Physical Oceanography Lab at Kutztown University to establish calibration curves. This will test the hypothetical relationships summarized in Figure 1 (i.e., evaluate the potential non-linearity of the relationship between jellybean count and acoustic output when shaken). In line with proper scientific protocol, we will shake all samples with several specific amplitudes and frequencies in both an x- and y-axis (Figure 3, Table 1), and only interpolate between standard values on the calibration curve. The purchase of jars with volumes differing from the one in Dr. Forsyth's classroom will be necessary for testing the effect of jar size on acoustic output. We will validate calibration curves by analyzing samples of unknown jellybean count, then manually counting beans in test jars.

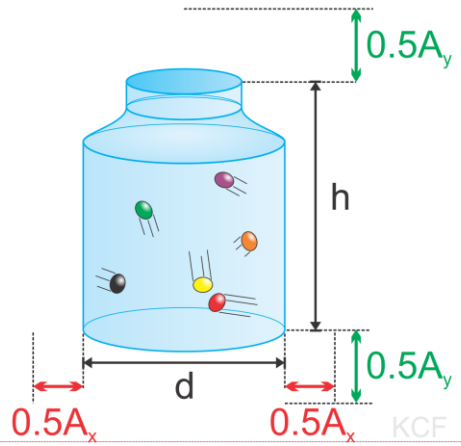

Figure 3. Acoustic response will depend on the size of the jar (diameter d and height h), number of beans (n), and amplitudes of agitation (A_x and A_y in the horizontal and vertical directions, respectively).

Data / Results to date (if applicable)

No results to date.

Discussion/Conclusions

The combined gravimetric and acoustic analysis of the data will allow a reliable estimate of the number of jellybeans in the jar. Using a conversion factor from the U.S. Food and Drug Administration, we can then calculate the total caloric value of the jar. This caloric value will then be compared to the graphs relating student output, sugar intake, and blood glucose level of Friehauf and Sherrod (2005). The total number of students who can be stimulated to produce more work using the jellybean jar will thus be calculated.

Table 1. Number of trials for acoustic analysis based on amplitudes (A) and frequencies of agitation

	Amplitude (A)		
Frequency	D§	hɔ	0.5*(d+h)
1 Hz	5	5	5
2 Hz	5	5	5
5 Hz	3	3	3
10 Hz	3	3	3

§ d = jar diameter ɔ h = jar height

The results of this study will be published in the Journal of Student Manipulation and presented at the annual meeting of the Slave-Driving Professors Association of America.

Commented [KF14]: Some data is best shown in graphics, and other data is best in tables.
Graphic representations illustrate patterns and trends that can get lost in the array of numbers in a table.
Tables summarize benchmarks and specific values better than graphic illustrations because the numbers are precisely stated for the reader rather than requiring eye-balling approximations.
Think about the message you are trying to communicate to your reader when choosing how you convey information.

Commented [KF15]: Justification for expenses in the budget are integrated into the narrative. Do not just ask for things without explanation - grant proposals are not capricious lotteries in which applicants win random wish lists of stuff. Budgets are reasoned estimates of the necessary costs to achieve success with the project.

Commented [KF16]: Although you may not have any conclusions because you have limited data, you may have some points of discussion that pull together ideas in the proposal and provide a cadence to your manuscript.

References

Erslev, Eric, 1987, Structural Geology, Colorado State University course Erslev, Eric, 1988, Field Methods, Colorado State University course

Erslev, Eric, 1989, Advanced Structural Geology, Colorado State University course

Friehauf, Kurt C., 2024, Diuretic effect or just old age? Coffee and the urge to pee in aging professors: International Journal of Tall Bald Guys, v. 33, no. 9, p. 12-13.

Forsyth, Jennifer, and Friehauf, Kurt C., 2023a, A quantitative analysis of jellybean consumption and its relation to student work output: Journal of Student Manipulation, v. 34, no. 6, p. 134-156.

Forsyth, Jennifer, and Friehauf, Kurt C., 2023b, Long-term adaptation of immunity to caffeine and the nullification of the potency of the brown nectar of the gods: Journal of Wisdom from Age, v. 1, no. 1, p. (don't remember so well anymore).

Grademonger, R., 2014, Strategies for dealing with school workloads by procrastination and assignment attrition: Journal of Undergraduate Student Survival, v. 6, no. 3, p. 22-31.

McCallum, M.E., 1985, Crystallography, Colorado State University course McCallum, M.E., 1986, Mineralogy, Colorado State University course McCallum, M.E., 1988, Geochemistry, Colorado State University course

McCallum, M.E., 1989, Exploration Geochemistry, Colorado State University course

Oakley, Adrienne, J., Friehauf, Kurt C., and Sherrod, Laura, 2015, Stimulation of students using sugar-rich foods – an indirect approach to increasing student workloads in athletics, crafting, and traditional music performance: Journal of Student Manipulation, v. 33, no. 1, p. 14-26.

Thompson, 1987, Introduction to Ore Deposits, Colorado State University course

Thompson, 1988, Hydrothermal Alteration, Colorado State University course

Thompson, 1989a, Fluid Inclusion Analysis, Colorado State University course

Thompson, 1989b, Advanced Ore Deposits, Colorado State University course

Tindall, Sarah, 2010, Brownian motion of human bodies induced by excessive ingestion of caffeine: American Journal of Atomic Physics Analogies to Human Behavior, v. 115, no. 2, p. 345-361.

Commented [KF17]: Reference list **must** include **only** papers that you've read and referenced in this document. Do **not** pad your reference list with a cut-and-pasted bibliography that you have not read, and which was not specifically cited as evidence in this work.

Timeline

March, 2025	Purchase jellybeans for deriving gravimetric calibration curve
April 1-8, 2025	Gravimetric analysis
April 12-15, 2025	Calibration of acoustic analysis curve (including counting standard jellybeans) and acoustic analysis
June 20, 2025	Presentation of results at National Association of Manipulative Professors (NAMP) in Harrisburg, PA

Commented [KF18]: It is important to indicate your intention to disseminate your results. Research completed but never published is research incomplete. Funding agencies want to know that their resources will have broader impact than the satisfying personal experience of the individual doing the research.

Budget

item	vendor	cost	use
Jellybeans	Giant	$ 200.00	
Milk	Giant	$20.00	wash down standard calibration jellybeans after determining curve
	Total	**$220.00**	
	Amount requested from KURF	$220.00	
	Amount covered by other sources	$0.00	From: ***n/a***

Biographical sketch of student

I am a geology major who is fascinated both by the physics of particle interaction and the chemistry of metabolic processes involved in the breakdown of rock candy (I am using jellybeans in this study, though, to save on costs). I am originally from Colorado, but moved to Pennsylvania to attend Kutztown University. I am working hard to become a quantitative geochemist so I can someday work for a large geochemical firm in the San Luis Valley of southern Colorado. This project will not only give me experience in the type of research I'd like to do in my career, but it will also enable me to attend a major scientific conference where I can learn about the cutting edge of my science, as well as meet established geologists and being developing my professional network.

I have emailed a high-resolution photograph of myself you as a separate jpg file – roughly 1-2 Mb in size.

Published abstract

n/a (yet!)