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## Teaching and Educational Method

# Bringing Behavioral Change Education to Life: Incorporating Healthy Eating into College Classroom Teaching

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### Abstract

This study evaluates the impact of implementing a Healthy Eating Challenge within the classroom setting. The activity integrated nutrition education, self-discovery/reflection, and community support. The findings underscore the potential of this approach to effectively educate college students about healthy eating and behavioral change models. This personalized active learning classroom project utilized a diverse array of effective educational strategies, including personalized goal setting, self-discovery and assessment, and creative expression of the Challenge experience. These strategies were employed to align behavioral change goals with an individual's readiness to embrace change. They served to foster a more comprehensive understanding of behavioral modification concepts and strengthen their reinforcement among college students. Throughout the Challenge, participants identified modifications that they would like to incorporate, such as enhancing meal balance, adding food variety, preparing food in advance, and eating breakfast earlier. This Challenge not only reshaped participants' perception of influential factors guiding behavioral transformations but also notably reduced the perceived barrier of inadequate cooking skills.

## 1. Introduction

Skipping breakfast has become a prevalent practice among college students worldwide (Wengreen and Moncur 2009; Neslişah and Emine 2011; Wright et al. 2015; Pendergast et al. 2016; Musaiger et al. 2017; Omage and Omuemu 2018; Sayed and Nagarajan 2022). This practice is associated with an increased risk of obesity (Kant and Graubard 2015), type 2 diabetes mellitus (Odegaard et al. 2013), hypertension (Lee et al. 2016), hypercholesterolemia (Ballon, Neuenschwander, and Schlesinger 2019), metabolic syndrome (Cahill et al. 2013), and coronary heart disease (Rong et al. 2019). Conversely, a meta-analysis by Li et al. (2021) finds that maintaining a regular daily breakfast routine benefits the cardio-metabolism which can reduce risk of cardiovascular diseases, type 2 diabetes mellitus, obesity, hypertension, stroke, metabolic syndrome, cardiovascular mortality, low high-density lipoprotein. However, future research is needed as gender may affect the results.

Several studies have evaluated the breakfast habits of college students. Pengpid and Peltzer (2020), using data from more than 20,000 college students across 28 countries, find that skipping breakfast is associated with ten health risk behaviors (e.g., inadequate intake of fruit and vegetables, frequent soft drink intake, binge drinking, and tobacco use), nine poor mental health outcomes (e.g., depression and sleep problems), and poor academic performance. Thiagarajah and Torabi (2009) find significant associations between irregular breakfast eating and health-compromising behaviors such as substance use, soda consumption, smoking, lack of sleep, and limited physical activities among 1,257 U.S. college students. In addition, more than 60 percent of the students attribute regularly skipping breakfast to poor time management (Thiagarajah and Torabi 2009). The literature consistently underscores the adverse effects of poor eating habits on the academic performance of college students (Thiagarajah and Torabi 2009; Wald et al. 2014; Reuter, Forster, and Brister 2021), while highlighting the cognitive benefits associated with a nutritionally balanced breakfast (Brandley and Holton 2020).

Various factors contribute to meal skipping in young adults. A review of 331 studies identifies individual influences (e.g., sex, age, ethnicity, body mass index, education level, physical activity, internet use, fatigue, psychological well-being, and cooking skills), social environmental influences, and physical environment influences (e.g., living environment and housing type) as risk factors for meal skipping (Pendergast et al. 2016). Other factors include meal cost and time constraints (Pendergast et al. 2016; Seedat and Pillay 2020) and being a college student (Wengreen and Moncur 2009). The transition to college or university marks a pivotal period for young adults, because it presents them with the first significant opportunity to independently make their own food decisions and translate their preferences into eating behaviors (Marquis 2005; Deshpande, Basil, and Basil 2009). However, college students are well-known for their suboptimal dietary habits (Deshpande, Basil, and Basil 2009) and disregard for food group recommendations (Dinger and Waigandt 1997), relying on quick and convenient meals (Marquis 2005; Morse and Driskell 2009). Unfortunately, existing health promotion strategies have largely overlooked college students (Hilger, Loerbroks, and Diehl 2017).

This paper investigates how education, self-reflection, and community support can be leveraged to promote behavioral change in eating habits among college students by integrating a Healthy Eating Challenge into classroom teaching. The objectives of this innovative classroom research project are as follows: (1) empower college students to self-discover their eating behaviors, gaining insights into how these behaviors influence both their physical and mental well-being; (2) cultivate awareness of effective strategies for healthy eating and provide support for the adoption of dietary habits; and (3) promote personalized learning and exploration. We envision, in the long run, these student participants will be empowered to develop confidence in discussing food-related matters, applying behavioral modification models to improve various aspects of individual well-being, and utilizing this model to educate others about healthy eating and behavioral modifications.

Despite the limited sample size of student participants determined by class enrollment, this paper showcases the potential of incorporating well-designed research activities in the classroom to not only encourage behavioral changes among college students, but also enhance engagement and foster immersive and experiential learning of food-related issues. The integration of the Healthy Eating Challenge project into the classroom holds promise for instructors and educators aiming to convey knowledge about eating behaviors and modification to college students, particularly those teaching courses at the intersection of food and nutrition.

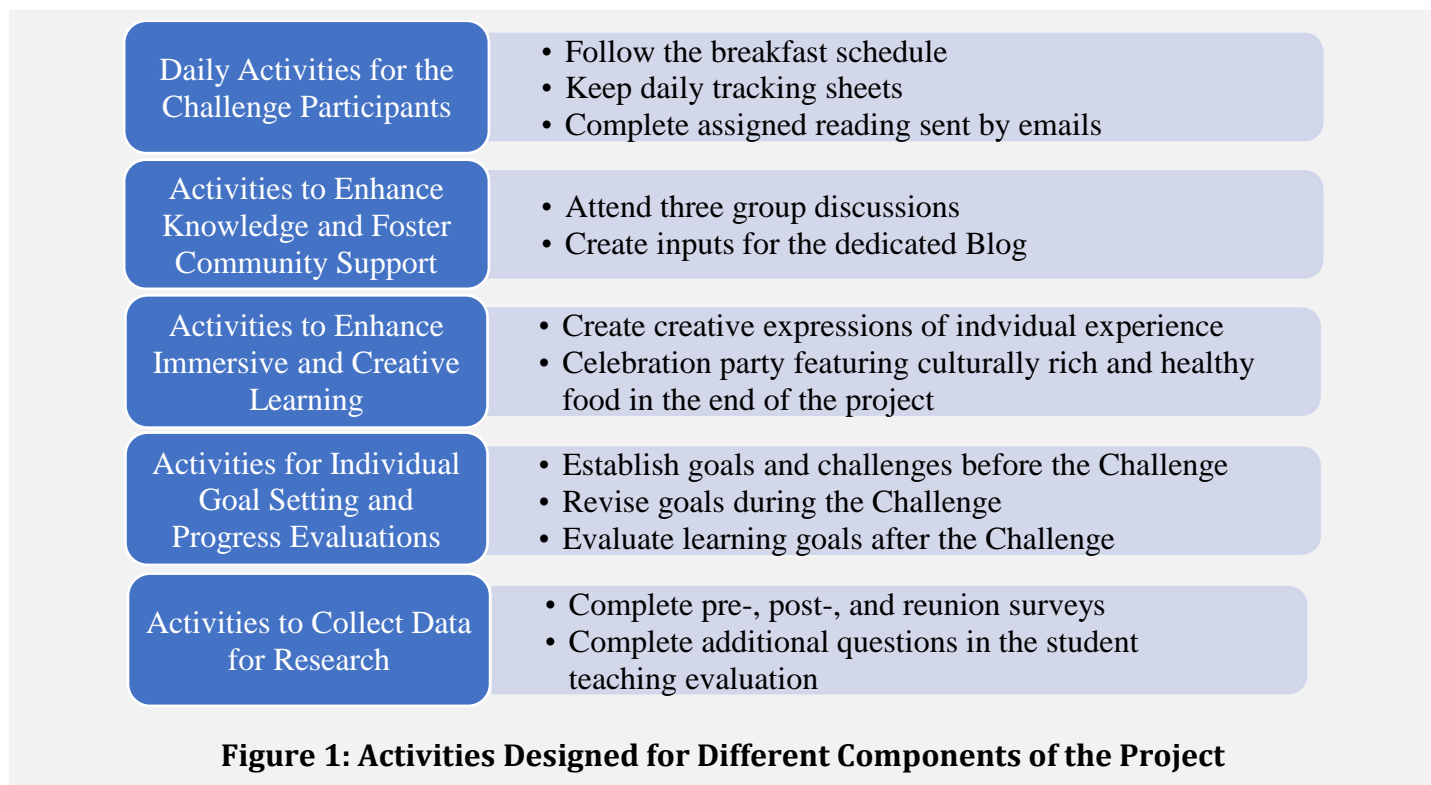
## **2. Procedures: Integration of the Research Project into Classroom Teaching**

This study was approved by the Rutgers Institute Review Board (IRB), ensuring adherence to ethical research standards for human subjects. Informed consent was obtained from student participants.

During the fall semester of 2022, undergraduate students who enrolled in two courses—“Food, Nutrition, and Health” and “Price and Demand”—were selected as a potential cohort for this study. Within the “Food, Nutrition, and Health” course, the Challenge was integrated as a required class project aligned with the course modules. Conversely, students in the “Price and Demand” course were offered the option to participate in the Challenge, while those who opted out were offered an alternative project opportunity. A total of 20 students undertook the Challenges in ten consecutive days. Two participants opted out of having their data utilized for research purposes, and the other two had considerable missing values in the pre- and post-challenge surveys, leading to a total of 16 student participants for the analysis. The small sample size warrants caution when generalizing the findings and constraining our ability to explore relevant questions.

### 3, The Design of the Healthy Eating Challenge

We collaborated closely with Eating for Your Health (EFYH), a nonprofit organization in New Jersey with a mission centered around promoting healthy eating across various demographics. Through this partnership, we have adapted and customized their renowned program, the Health Eating Challenge program, to effectively address the unique requirements and attributes of college students and align them with the curriculum, modules, and schedules of the two courses. Figure 1 depicts the activities designed for various components of the project, including daily activities for the project participants, initiatives to foster community support, activities to enhance immersive and creative learning, tasks for learning goals and progress assessment, and activities to collect data for program evaluation. Details of each component are discussed in the following sections of this paper.



Participants were required to follow the breakfast schedule (see Table 1) and utilize the provided daily tracking sheets to facilitate self-discovery. This tracking sheet served as a tool for participants to document their post-breakfast experiences, encompassing aspects such as physical vitality, mental energy, concentration levels, hungry cues, and food cravings.

Throughout the Challenge’s duration, participants received daily emails containing assigned readings. The assigned readings encompassed a variety of materials, such as short academic papers, previous Challenge participants’ stories and narratives, cooking videos, or educational articles. Each reading was meticulously curated by EFYH and the research project investigators, ensuring that two vital objectives were achieved: (1) conveying pertinent nutritional knowledge and (2) motivating participants to engage in self-exploration of their eating behaviors and overall well-being. Additionally, a daily checkup quiz was accessible on Canvas (the official learning management system for teaching and learning at Rutgers) throughout the Challenge period to serve as a mechanism to gauge and maintain participants’ engagement.

To ensure a continued thread of awareness and support throughout and beyond the Challenge, participants created an interactive blog page where they posted pictures and videos of the breakfast foods they made. The Challenge facilitators took on the role of both cheerleaders and sources of information. They were readily available to address participants’ questions and concerns. Furthermore,

**Table 1: Recipes and Readings for the Healthy Eating Challenge**

Day	Breakfast Schedule	Reading Materials
1	Usual Breakfast	Food Flavor
2	Usual Breakfast	Food and Mood
3	Egg or Tofu Scramble	Lucia’s Story About Dark Chocolate
4	Egg or Tofu Scramble	Video: Making Breakfast Chili
5	Chili for Breakfast with Turkey/Tofu	Journal Article on Chili Pepper
6	Chili for Breakfast with Turkey/Tofu	Food and Dehydration
7	Magic Muffin or Oatmeal	Oils
8	Magic Muffin or Oatmeal	Dirty Dozen and Clean 15
9	Chia Seed Pudding or Smoothie	Flaxseed
10	Chia Seed Pudding or Smoothie	Journal Article on Breakfast Skipping and Late-Night Eating

the Challenge organized three group sessions on Days 1, 5, and 10. An orientation was provided in the first group session. In the second group session, the facilitators presented information on carbohydrates, sugar, and dietary fiber to dispel myths and highlight facts. The third group session, held upon the Challenge completion, focused on revealing the nutritional value of the provided recipes and emphasized the importance of self-journaling and self-discovery in eating behaviors. During these group sessions, participants were encouraged to share their stories and ask questions. In addition, the research investigators allocated 5–10 minutes either before, during, or after class to engage participants in a brief discussion about the Challenge. This frequent interaction nurtured a dynamic and supportive learning environment.

#### 4. Evaluation of the Healthy Eating Challenge

Using the survey data, we present information of demographics and eating behaviors prior to the Challenge in Table 2, and participants’ frequencies of eating breakfast, perceived facilitating factors and barriers, level of readiness to change, and desirable behavioral changes in Table 3.

Participants were evenly distributed by gender, with a higher representation of seniors (81 percent). A significant portion of them were pursuing studies in environmental and business economics (79 percent). Regarding ethnicity, the cohort was predominately non-Hispanic white (44 percent), followed by Asian (25 percent), Hispanic (19 percent), and multi-race (13 percent) participants.

As for living arrangements, over two thirds of participants resided in apartments within walking distance to campus (69 percent). When it came to budgeting, participants reported an average weekly expense on groceries of \$81, with nearly half provided by their parents (\$40). Participant aspirations for the Challenge were to gain nutritional knowledge (88 percent), self-evaluate eating behaviors (75 percent), improve health conditions (38 percent), and improve cooking skills (25 percent).

As shown in Table 3, before the Challenge, a quarter of participants reported that they never prepared or cooked breakfast, and only one third ate breakfast at least 3–4 times per week. After the Challenge, approximately 88 percent of participants reported having breakfast at least 3–4 times per week. This post-Challenge frequency significantly surpassed the pre-Challenge rate. Table 2 also shows that a quarter of participants expressed dissatisfaction with their eating behaviors prior to the pre-

**Table 2: Demographics of Survey Participants (N = 16)**

Demographic	Mean	Standard Deviation	Min	Max
Age (years)	21	1	19	23
Weekly grocery expense (\$)				
Paid by oneself	43	36	0	100
Paid by parents	39	35	0	100
Gross	82	33	0	150
	<b>Percent</b>			
Female	50			
Class Rank				
Senior	81			
Junior	19			
Race				
Non-Hispanic White	44			
Hispanic	19			
Asian	25			
Multi-Race	13			
Major				
Environmental and Business Economics	79			
Nutritional Sciences	11			
Agricultural and Food System	5			
Political Sciences	5			
Living Arrangement				
Apartment/house away from campus	6			
Outside within walking distance to campus	69			
On campus	13			
Living with parents	13			
What Students Want to Learn from the Challenge				
Nutritional knowledge	88			
Self-assessment of eating behaviors	75			
Improve cooking skills	25			
Improve health condition	38			

Challenge. This dissatisfaction was likely to encourage participants to modify their eating behaviors throughout the Challenge.

To validate participants' readiness for behavioral change, they were asked to evaluate their readiness on a scale of 0 to 100, and to indicate whether they were ready to make changes. Table 3 reveals a notable inclination toward lifestyle changes after the Challenge. Specifically, participants indicated a greater readiness for change after the Challenge (80 percent) compared to before the Challenge (64 percent), as measured by their readiness scale. The difference was statistically significant at the 10 percent significance level. This difference showed the efficacy of the Challenge in cultivating a mindset conducive to change among participants. Based on their recorded binary preferences, the majority reported their intention to either maintain the changes they had already made during the Challenge or embrace new modifications in the post-Challenge period (94 percent), which was statistically significantly higher than the pre-Challenge level (57 percent) at the 1 percent significance level. This observation underscores the potentially transformative impact of the Challenge on

**Table 3: Breakfast Frequencies and Perceived Facilitating Factors, Barriers, Readiness, and Identified Areas for Behavioral Changes**

	Pre-Challenge (%)	Post-Challenge (%)	Difference (%)
<i>Satisfaction with What and How You Eat Breakfasts</i>			
Dissatisfied	25	0	-25**
Neutral	25	7	-18**
Satisfied	50	93	47***
<i>Frequency of Breakfast Preparation or Cooking in a Typical week</i>			
Never	25	0	-25**
Only on weekends	0	0	N/A
1–2 times per week	44	9	-35**
3–4 times per week	13	55	42**
5 and more	19	36	18
<i>Factors Facilitating Behavioral Changes<sup>§</sup></i>			
Nutrition Knowledge/Information	63	69	6
Cooking Skills	63	69	6
Community Support	44	6	-38***
Health Considerations	69	31	-38**
The Healthy Eating Challenge	N/A	56	N/A
<i>Barriers to Behavioral Changes<sup>§</sup></i>			
Affordability	38	31	6
Cooking Facilities	13	13	0
Cooking Skills	38	19	19*
Time Constraint	81	88	6
<i>Readiness for Behavioral Change</i>			
Based on a 1–100 scale	64	80	15**
Based on indication (yes/no)	57	94	38***
<i>Anticipated Changes to Breakfast after the Challenge<sup>§</sup></i>			
Improve meal balance		57	
Increase food varieties		57	
Prepare food in batches the night before		50	
Increase fiber consumption		32	
Eat breakfast earlier		38	
Take time to enjoy breakfast		25	

Notes: <sup>§</sup>Student respondents can choose all applied when answering these questions. \*\*\* 1%, \*\* 5%, \* 10%

participants’ commitment to long-term change. The Challenge not only significantly increased participants’ readiness for change, as evidenced by their higher average readiness rating, but it also inspired participants to commit to sustaining or further enhancing their positive changes. Despite its small sample size, this transformation in readiness and intention represents a potential of the Challenge in fostering a proactive and empowered approach to dietary and lifestyle improvements among college students.

Following the challenge, participants identified a common priority in terms of preferred behavioral changes. This stage was critical in understanding the specific areas where participants felt they could make meaningful adjustments to their eating habits. Enhancing meal balance and varieties, preparing food in batches in advance, and eating breakfast earlier emerged as the predominant choices.

Participants were also asked to identify facilitating factors and barriers to behavioral changes in the pre- and post-Challenge surveys. Common facilitating factors for behavioral changes were nutritional knowledge and cooking skills before and after the Challenge. Initially, participants perceived community support in the shared student-led blog and discussion in and out of the classroom as a facilitating factor (44 percent). However, the perception diminished after the Challenge (6 percent), with statistical significance at the 1 percent level. Similarly, a greater number of participants perceived health considerations to help make behavioral changes before the Challenge (69 percent) compared to after the Challenge (31 percent), with statistical significance at the 10 percent level. The differences relating to community support and health considerations could be attributed to improved autonomy relating to eating behaviors. Moreover, more than half of participants perceived the Challenge itself as a facilitating factor for behavioral changes (56 percent). The participants' evolving perceptions of facilitating factors and barriers to behavioral changes reflected their growth and empowerment throughout the Challenge. The Challenge not only equipped participants with knowledge and skills but also instilled a sense of self-reliance and motivation. This shift from external to internal motivators underscores the lasting impact of the Challenge as a catalyst for sustainable behavioral change. In accordance with the Transtheoretical Model of Change (TTM), participants' enhanced autonomy and self-efficacy in managing their eating behaviors position them to continue their journey toward improved nutrition and well-being beyond the confines of the Challenge (Horwath 1999; Spencer et al. 2007)

A common barrier to behavioral changes, both before and after the Challenge, was the constraint of time. This finding is consistent with the existing literature that underscores how time constraints often drive college students to rely on quick and convenient meal options (Marquis 2005; Morse and Driskell 2009) and to frequently skip meals (Wengreen and Moncur 2009). Conversely, the perception of cooking skills as a barrier diminished post-Challenge, suggesting increased confidence in this aspect. The percentage of participants considering affordability and lack of cooking facilities as barriers was not statistically different before and after the Challenge. The barriers identified in this study illuminate the complex interplay of factors influencing college students' eating behaviors. While the Challenge succeeded in improving cooking skills and potentially boosting participants' confidence, it did not fully mitigate the time constraints they faced. This underscores the need for multifaceted interventions that not only educate students about healthy eating but also offer practical solutions for addressing time-related challenges, affordability issues, and cooking facility limitations. By comprehensively addressing these barriers, educational institutions and health promotion initiatives can better support college students in their journey toward improved nutrition and well-being.

## 5. Educational Tools for Behavioral Changes Embedded in the Challenge

As Figure 1 indicates, we used several educational tools employed to fulfill the stated three primary objectives, including self-journaling and personal discovery, goal setting and assessment, community support, and creative expressions of the Challenge experience. In this section, we examine the effectiveness of these education tools and provide insights into optimizing the effectiveness of these tools. Our analyses draw from qualitative data obtained through students' learning goals, self-evaluation of these goals, and final reflection projects, along with quantitative data provided by the additional questions in the student teaching evaluation.



### 5.1 Self-Journaling and Personal Discovery

Self-regulation theory suggests one may have the ability to adaptively regulate their attention, emotion, cognition, and behavior to respond adaptively to both internal and external demands (Baumeister, Tice, and Vohs 2018). One important component of self-regulation ability is self-assessment and discovery. During the challenge, participants were asked to observe, document, and contemplate their post-breakfast experiences with the provided recipes provided using tracking sheets. The suggested items for self-journaling were physical vitality, mental energy, breakfast satisfaction, hunger cues, food cravings, and any other pertinent observations.

Tracking sheets facilitated the completion of the post-Challenge survey. Within these surveys, participants were asked to report hours they experienced hunger, rate their energy level, food cravings, and attention on a scale from 1 (lowest) to 5 (highest), and rank their mood from 1 (worst) to 5 (best) after each breakfast during the Challenge. Based on the survey data, we conducted student t-tests to compare self-reported feelings after eating the provided recipes vs. after eating their typical breakfast. The results are summarized in Table 4.

**Table 4: Feelings After Having Breakfasts and Macronutrient Contents of the Provided Recipes**

Recipes	Self-reported feeling after breakfast				
	Hours feeling hungry	Energy 1 = lowest 5 = highest	Mood 1 = worst 5 = best	Food Craving 1 = lowest 5 = highest	Focus/Concentration 1 = lowest 5 = highest
<i>Pre-challenge breakfast</i>	2.17	2.77	3.54	2.77	2.77
<i>Breakfast during the Challenge</i>					
Egg Scramble	2.64**	3.23*	3.77	3.23**	3.23**
Tofu Scramble	2.20	3.20*	3.40	3.20*	3.20*
Breakfast Chili	<b>3.33**</b>	<b>3.62**</b>	3.43	<b>3.62**</b>	<b>3.62**</b>
Magic Muffin	1.83	3.33	3.50	3.33	3.33
Overnight Oats	2.64	3.33*	3.69	3.33*	3.33*
Smoothie for Challenge	2.15	3.15	4.08	3.15	3.15
Chia Seed Pudding	2.17	3.20	<b>4.33*</b>	3.20	3.20

*Note:* The statistical significance, \*\*\* 1%; \*\* 5%; \* 10%, pertains to the comparison between a specific breakfast recipe and pre-challenge breakfast. The numbers bolded indicate the highest value in the category.

Table 4 shows that the provided recipes had varying effects on self-reported experiences. When compared to the pre-challenge breakfast, both breakfast chili and egg scramble demonstrated better satiety, increased energy, and enhanced concentration, along with shortened hours of hunger after consumption. Additionally, compared with the pre-challenge breakfast, both egg scramble and breakfast chili sustained participants longer at the 1 percent and 10 percent significance levels, respectively. Egg/tofu scramble, breakfast chili, and overnight oats yielded higher energy and improved concentration, albeit increased food craving. Notable, among all the provided recipes, only the chia seed pudding demonstrated a statistically significant improvement in mood at the 10 percent significant level when compared to the pre-Challenge breakfast.

In the third group session after completing the Challenge, participants were presented with the nutritional profiles of the provided recipes, including the percent daily value for total fat, total carbohydrates, dietary fiber, protein contents (gram), and total calories. They were guided to explore the reasons behind variations in how they felt after eating different breakfasts during the Challenge. For example, through this exercise, participants better understood the reasons behind breakfast chili yielding the highest level of energy and concentration, while also sustaining them for the longest time among all the recipes.

We employed these exercises to achieve three goals. First, it offered students a valuable opportunity to learn about the notion of balanced meals. Balanced meals containing the appropriate macronutrients — carbohydrates, fat, and protein — can potentially improve cognition, memory, and attention in young adults. For example, meals rich in complex carbohydrates have been linked to improved attention (Fischer et al. 2002), facilitating verbal declarative memory (Smith et al. 2011), improving working memory performance (Scholey, Harper, and Kennedy 2001), and amplifying prospective memory (Riby et al. 2011). High-fat meals have demonstrated the potential to enhance attention, while protein-rich meals have shown to improve cognitive improvements (Fischer et al. 2001). Second, these exercises provided students with first-hand insight into how the composition of their meals could significantly influence cognitive functions and contribute to their overall well-being. Last, these exercises served as an instructive platform for students to better understand the importance of paying attention to nutritional profiles of their dietary choices, cultivating mindfulness, and engaging in self-journaling. A growing body of literature suggests that mindfulness, characterized by embracing and non-judgmental acknowledgement of past and present experiences, contributes to transformative and profound changes in health behavior (Shapiro et al. 2006; Schuman-Olivier et al. 2020). In addition, during the third group discussion, participants also learned how to use online resources, such as the Recipe Nutrition Calculator from [www.verywellfit.com](http://www.verywellfit.com), to engage with nutritional labeling and evaluate nutritional profiles of their dietary choices. This aspect of the exercise equipped students with essential proficiencies to adeptly navigate their dietary choices through contemporary technological tools.

Students' reflections on their experiences suggest that they have gained insights into the importance of balanced meals with variety. One student expressed, "...by expanding the nutrients within my day-to-day breakfast, I increased my energy level partially... like to increase varieties in my meals." Another highlighted "the importance of practicing balance and flexibility within your eating..., especially the need for consuming more calorie-dense meals within an active lifestyle." Another noteworthy example involves a student providing a detailed reflection of her relationship with food, strategies for weight control, and her transition to a vegetarian and vegan diet since high school. She acknowledged acquiring knowledge from this experience and highlighted modifications in her eating habits, such as incorporating more whole foods and reducing snacking, despite facing challenges in maintaining healthy eating in the long run.

## 5.2 Goal Setting for Behavioral Modifications

Goal setting is widely acknowledged as a potent technique for behavioral changes, with the capacity to serve as a cornerstone in the success of interventions (Epton, Currie, and Armitage 2017). This technique has shown some promise in promoting dietary behavior changes (Shilts, Horowitz, and Townsend 2004). Individuals face different challenges when it comes to goal setting. For example, identifying suitable goals effectively translates their goals into actionable steps (Bailey 2019).

At the outset of the Challenge, participants were asked to establish their learning goals, with an option to revise these goals. These goals served as reference points for participants to assess their progress and accomplishment throughout and after the Challenge. Throughout the duration of the Challenge and beyond, participants were provided with chances to communicate and deliberate on their goals with the course instructor who served as one of the research investigators. This process encouraged an adaptable and reflective assessment of their personal growth, ultimately inducing behavioral changes.

Appendix A provides a summary of individual students' learning goals before the Challenge and their self-evaluation afterward, indicating the achievement of most learning goals. The majority highlighted their exposure to and acquisition of knowledge regarding nutritional values, micronutrients, balanced meals, and the importance of serving size and having breakfast. Many reported a shift from rarely or never cooking breakfast to doing so more frequently; incorporating healthier ingredients, including non-processed ones, in meal preparation; organizing ingredients to ensure balanced meals;

and preparing large portions for future meals. Most participants reported increased awareness of their eating habits and the impacts of breakfast on their well-being. Some mentioned prioritizing health and translating gained knowledge into behavioral modifications. A few reported improvements in time management. Two students indicated enhanced media creation skills. Notable, one participant acquired knowledge in food safety, and another pleasantly discovered an unexpected enjoyment and aptitude for cooking. Two students recognized cost saving when preparing breakfasts themselves. Additionally, one participant started to recognize and appreciate the influence of her Asian heritage on dietary preferences and behaviors.

### **5.3 Creative Expression of Individual Challenge Experiences**

Existing research has consistently shown that creative expression promotes active and personalized learning (Kousoulas 2010; Brown 2015; Beghetto 2021). Student participants were given an opportunity to create creative and artistic expressions of their individual Challenge journey. As shown in Appendix B, students submitted a diverse range of introspective expressions, including written narratives accompanied with photos (N = 4), videos of storytelling or breakfast cooking (N = 3), blog posts (N = 2), and infographics (N = 7). This exercise not only made this experiential learning enjoyable, but also stimulated reflections that are important in active and personalized learning. As shown in Appendix A, nearly all the participants acknowledged an enhanced self-discovery and reflection of their eating habits and the impact of breakfast on their well-being. Among the two students who reported an improved media creation skill, one recognized such skills could enhance employability.

### **5.4 Community Support**

Community support comprises several components, such as three group meetings, and a shared blog, as well as both informal discussion with the instructor and among peers within and outside the classroom. During the group meetings and informal discussions, participants demonstrated a willingness to share their experiences and pose questions. Despite many posted photos of their breakfast preparation, cooking, and consumption in the shared blog, the investigator noted a lower level of enthusiasm among student participants for this aspect. As we discussed in Section 4, there was a notable decrease in the perceived importance of community support among student participants, in contrast to their pre-Challenge perceptions. The shift may be attributed to improved autonomy regarding eating behaviors and/or a diminished interest in this specific component.

## **6. Students' Perception of the Role of this Challenge Project in their Active and Personalized Learning**

Overall, the project investigators perceived that self-journaling and personal discovery, goal setting and assessment, three group discussions, and creative expressions of the Challenge experience collectively engaged and empowered student participants. They empowered student participants to self-discover their eating behaviors and gain insights into how these behaviors influence both their physical and mental well-being. These tools also cultivated awareness of effective strategies for healthy eating and provided support for the adoption of beneficial dietary habits.

To assess students' perceptions of the project's role in their active and personalized learning, five questions were incorporated in the Rutgers student teaching evaluation survey for the course titled "Food, Nutrition, and Health", where the Challenge was integrated as a required class project. Participants were asked to express their agreement with the statements listed in Table 5 on a scale from 1 (strongly disagree) to 5 (strongly agree). Although only four students completed the evaluation, their responses offered some insights. As shown in Table 5, all of them reported that the project engaged them in active learning both individually and collectively, and it also improved their personalized learning. They also noted that the project integrated learning into their daily lives and assisted them in modifying behaviors in eating habits.

**Table 5: Students’ Perception on Active and Personalized Learning**

Statement	4 (agree)	5 (strongly agree)
Learning goals specified by individual students were helpful for personalized learning.	75% (N=3)	25% (N =1)
The project improved personalized learning.	25% (N=1)	75% (N=3)
The project engaged students in active learning individually as well as in a group.	0% (N =0)	100% (N=4)
The project brought learning into students’ daily life.	50% (N=2)	50% (N=2)
The project helped me modify my eating behaviors.	50% (N=2)	50% (N=2)

*Note:* Four students completed the student teaching evaluation in the end of the semester.

Two educational strategies, not implemented in our project but potentially beneficial for those considering adopting this integrated project in their classroom, deserve mention. First, we observed that student participants often faced challenges when attempting to refine their ambitious learning goals into practical and accountable objectives. SMART objectives, a systematic framework known for being Specific, Measurable, Achievable, Relevant, and Time-Bound, can empower individuals to focus on well-defined goals, track their progress, and align their aspirations with measurable outcomes (Centers for Disease Control and Prevention 2003; Pearson 2012). Incorporating SMART objectives into this project could further enhance learning and increase success. Second, beyond the diverse creative expressions of the Challenge experience, student participants can work collaboratively to create a script for a podcast or TED talk. Such collaborative endeavors not only foster teamwork but also reinforce ownership of learning experiences and outcomes.

## 7. Conclusions

This study demonstrates the effectiveness of a well-designed project that integrates nutrition education, self-discovery and reflection, classroom-based community support, and creative expression in educating college students about healthy eating, promoting behavioral changes, and fostering active, personalized experiential learning. This study made optimal use of quantitative data from the pre- and post-Challenge surveys and student teaching evaluation surveys. In addition, we leverage various qualitative data sources, such as goal setting and evaluation, final reflection projects, group discussions, and blog posts. We find that college students were more likely to enhance behavioral changes after the Challenge, and they identified their desired changes toward healthy eating such as enhancing meal balance and varieties, preparing food in batches in advance, and eating breakfast earlier. The Challenge also reshaped their perception of influential factors guiding behavioral transformations.

The success of this project can be attributed to its incorporation of personalized goal setting, nutrition education, and daily tracking of breakfast experience to foster self-discovery, community support both within the classroom and through a shared blog, and the requirement for students to submit a final artistic reflection project based on their Challenge experience and in their own choice of format. Additionally, given that student participants enrolled in two courses in food consumption, nutrition, and health-related areas, the Challenge aligned well with the course content. This alignment played a significant role in the success of promoting a comprehensive understanding of behavioral modification concepts and effectively reinforcing changes among participants. This project demonstrates the potential for educators teaching courses at the intersection of food and nutrition to offer valuable and immersive learning on healthy eating to young adults.

Nevertheless, this study does have its limitations. First, the study sample is small (N = 16), necessitating caution when generalizing the findings and constraining out ability to explore relevant questions. For example, we collected sociodemographic information about student participants, including their major, ethnicity backgrounds, living arrangements, financial support, and project aspirations. This information could offer valuable insights into the diverse and multifaceted nature of college students’ dietary choices and behaviors. Investigating the role of sociodemographic factors in

influencing behavioral changes among college students could inform interventions and educational strategies. Regrettably, our sample size does not permit us to conduct such a quantitative analysis. Second, a reunion survey conducted toward the end of the semester to assess the sustainability of behavioral changes faced low participation rates, primarily due to students' stress during the final exam week. The lack of data limits our ability to assess the long-term effects.

Despite the limitations, particularly associated with our small sample size, this comprehensive project offers college students the opportunity to learn about and practice behavioral changes, potentially enhancing their overall college experience and long-term health outcomes. It can be readily adapted by educators aiming to convey knowledge about eating behaviors and modification to college students, particularly those teaching courses at the intersection of food and nutrition.

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## Appendix A: Individual Students’ Learning Goals Before the Challenge and Their Self- Evaluation After the Challenge

**Table A1: Individual Students’ Learning Goals Before the Challenge and Their Self- Evaluation After the Challenge**

Learning Goals	Achieved (yes/no)	Selective Quotes from Students
<i>Panel A: Discovery and reflection</i>		
Be more aware of my diet, eating habits, and how my body feels	Yes	Learned about serving size, calorie count, and preservatives
	Yes	Want to learn how my body feels when getting into a schedule of eating breakfast since it has never been part of my routine.
	Yes	Want to learn how my energy can change throughout the day and how breakfast can make me start the day with more energy.
	Yes	My physical energy was much better on days that I ate breakfast although it did not really help my mental fog in the morning.
	Yes	Learn how food affects my body’s energy
	Yes	I have specifically noticed a difference with intake of vegetables and fiber. My increased intake of fiber has helped greatly with digestion throughout the day and overall.
	Yes	This challenge has also made me try to keep my breakfast at the same time each day.
	Partially	I did find myself being more aware of my eating habits and began to question myself when I’d crave unhealthy food and instead try to find something less processed and more nutrient-dense.
	Yes	It may be a challenge to observe my energy levels because many other factors may tie into why I would be more/less energetic throughout the day...To combat this challenge, for the duration of the Healthy Eating Challenge, I will try to keep my sleep and activity levels and other nutritional variables consistent.
	Yes	I was more aware of how breakfast foods immensely impacted my energy levels throughout the day.
Learn and document what works best for me in terms of eating	Yes	I learned that certain foods will give me more energy, and keep me full for longer.
	Yes	Daily journaling helped me to pay close attention to what types of foods affect me in certain ways.
See how different food affects body weight	No	There was not enough time to see an actual effect on body weight. If I continue these healthy eating habits, I’m sure I will notice a healthy change in weight.

**Table A1 continued.**

Learning Goals	Achieved (yes/no)	Selective Quotes from Students
<b><i>Panel B: Gain knowledge of nutritional values</i></b>		
Understand the importance of having breakfast	Yes	Expand my knowledge on why it's important to eat breakfast
Learn more about micronutrients	Yes	The project encouraged me to learn more about micronutrients and vitamins. For example, I chose to add spirulina powder to my smoothies to increase the vitamins and minerals, which was not part of the given recipe.
Learn about nutritional values and daily intakes	Yes	It was beneficial to know why certain foods we should have in one meal. The daily email and presentations explained well on that.
Learn about balanced meals	Yes	I always knew it was important to have balanced meals, but now I have a lot more knowledge of why it is important.
Understanding the composition of recipes	Yes	I learned a lot on what to have in a recipe and how to make it easy to follow. It was clear about the amount of food we need and proper cooking sequence.
	Yes	Since I'm used to eating frozen breakfast sandwiches or buying a bagel from somewhere, this project showed me cheaper and more nutritional ways I could utilize the ingredients I have at home to make my breakfast every morning.
<b><i>Panel C: Behavioral modification of eating habits</i></b>		
Incorporate healthier ingredients	Yes	
Prepare meals from non-processed ingredients	Yes	
Cook and eat breakfast more frequently	partially	My class schedule hasn't changed since the Challenge started, and it does not permit me to cook for myself every single day.
	Partially	I continue to struggle to eat breakfast consistently.
	Yes	I felt excited to try the new recipes in the morning. I rarely cook meals for myself in the morning, so it was a good opportunity.
	Yes	I found myself consistently eating real meals throughout the day. This is very unlike me because I often snack throughout the day instead of making full meals.
Learn about time management and health priorities	Yes	Learned about efficient time management and prioritizing cooking breakfast
Improve cooking skills	Yes	I learned several skills of meal preparing and cooking that are easy for me to incorporate into my everyday life.

**Table A1 continued.**

<b>Learning Goals</b>	<b>Achieved (yes/no)</b>	<b>Selective Quotes from Students</b>
Have a balanced breakfast	Yes	Having an assortment of ingredients is helpful to keep a balanced meal. I enjoyed how the large portions allow me to save it for future meals.
Maintain a healthy lifestyle during the Challenge and even after the Challenge	Partially	Did wake up a bit early to prepare breakfast. However, need efforts to maintain it.
Prioritizing health and transform knowledge into action	Yes	I never expected the things to come out of the Challenge to affect my daily life. Yet, I've started to put my health first and the knowledge I know from nutrition to action.
<i>Panel D: Other skills learned</i>		
Improve media creation skills	Yes	Gaining practice with TikTok and YouTube to upload and edit digital media content were all extremely helpful for the future, whether in classes or in the workplace. As the world of advertising and marketing moves digitally, these skills can help separate employees and brands from those without these proficiencies.
	Yes	Since I decided to make cooking videos for my deliverables, I also learned a lot in editing videos
Stay on top of scheduling and deadlines	Yes	I tried to edit and post all videos to TikTok and the class blog on the days we were eating them, to ensure that they were accessible to Dr. Jin and Dr. Wagner. Also, since they were instructional, they could help other students who struggled to make the dishes. This has built my daily routine to be a lot better and has even helped with my sleep schedule.
Time management	Yes	

**Panel E: Unexpected learning and achievements**

Food safety: Got food poisoning for failure to know that chili quickly spoils.

Food preference: The chili was so nice, and I was able to make it again after the Challenge.

I didn't expect to like the chili, but I really enjoyed it and will make it again soon.

Cooking preference: I unexpectedly learned that I enjoy cooking. There is a sense of accomplishment when cooking a meal successfully.

Breakfast and snacking: I found that, when eating a nutritious and filling breakfast, I was less likely to snack throughout the day.

Budgeting: I was aware how much money I saved from just cooking/making my breakfast for the week!



## Appendix B: Creative Expression of Individual Challenge Experiences

The Challenge participants provided a diverse range of introspective expressions, including written narratives accompanied with photos (N = 4), videos of storytelling or breakfast cooking (N = 3), blog posts (N = 2), and infographics (N = 7). Below we showcase some of them.

Format  
Video

Students' Creative Expression of Their Challenge Experiences

<https://youtu.be/7q7-Lm197j0>

<https://youtu.be/Iv8FjdyhtoI>

<https://youtube.com/playlist?list=PLo0P3BngvEXZXigf9ipC35biFFII6o4kw>

Written  
Narrative  
with  
photos



**Health EATING CHALLENGE**

**My Personal Experience with the Health Eating Challenge:**

Before the Health Eating Challenge, I usually ate a Jimmy Dean frozen breakfast sandwich or a bagel and I would start to get hungry an hour or two later. Frozen breakfast sandwiches are usually high in calories, saturated in fat, and low in fiber, which sets me on a rise-and-crash cycle for the rest of my morning/afternoon. Although bagels are packed with a lot of carbs, they can fit a balanced plate when paired with protein and fat! Meaning, incorporating a bagel into your breakfast once in a while is often a good source of complex carbohydrates.

From the 11-day challenge of prepping and eating a variety of breakfast foods, I've learned that I prefer eating meals that are quick, easy to prepare, and deliver a good amount of energy for the day. From eating more energy-fulfilling meals like chili and oats for breakfast, I've noticed a dramatic change in energy levels and appetite management. Especially through this challenge, I have learned that eating more calorie-dense meals is essential to having a healthy diet, especially since I go to the gym almost every day. Eating hearty foods for breakfast, sets a healthful tone for the rest of the day and improves my nutritional needs.

**Two things that I have learned from the Health Eating Challenge,** highlight the importance of practicing balance and flexibility within your eating and that enjoying exercise comes with having a good relationship with food, which supports a range of positive health outcomes. Especially the need for consuming more calorie-dense meals within an active lifestyle.

**One thing I would like to share with others** is that cooking and cleaning take time but healthy food has value and fills you up. Taking a small portion out of your day is worth creating a healthy relationship with food and for long-term health benefits.

**One thing you would like to change in this Healthy Eating Challenge** would focus on finding more quick and nutritional breakfast ideas, instead of the long meal prep of Chili in the morning. One thing I would change in my personal diet is to make time to prepare more nutritious meals in the morning, instead of eating a frozen breakfast sandwich or a bagel every day.

Infographic

Lynette Vasquez

# Healthy Eating Challenge Learning Results



### Oatmeal benefits

- ↳ High in fiber
- ↳ Has soluble & insoluble fiber
- ↳ Rich in carbs
- ↳ Lower cholesterol
- ↳ Reduce blood sugar
- ↳ Boost immunity
- ↳ Zinc, Iron, Manganese filled
- ↳ Antioxidants, including phytic acid, vitamin E, phenolic compounds
- ↳ Improve digestive movements

These are some of the things I learned while doing the challenge and reinforced through my understanding if other classes affecting food and taste

### Chia seeds benefits

- ★ Build muscles
- ★ Boosts Body Metabolism
- ★ Improves digestive health
- ★ Antioxidants
- ★ Rich in nutrients
- ★ High in fiber



Trans fats are fats that are hydrogenated oils which can increase heart attacks, stroke, high cholesterol, and more. While Saturated fats are found in oils such as olive, sunflower, nuts, avocado, corn, and soybean.



Cultural indulgences/ cultural foods play a large factor in nutritional health, especially when meeting with a nutritionist or someone to talk about the food you are eating to have a balance of fruits, vegetables, fats, sodium, sugar intake, and etc.

The tastebuds have 5 different taste receptors; Sweet, Sour, Bitter, Umami & Salty.

The Bitter, Sweet & Umami have protein receptors, while the Sour & Salty most likely have ion channels.

The ion channels process is your body having to contain channels under the taste bud for salty & sour that open and close once having a food with salt or spices that touch your tastebuds.

The protein receptors is the process of having your taste buds stimulated, which then get processed through transduction mechanisms that then travel to the nerve endings, and end up in the frontal lobe of the cerebral cortex which is then decoded by neurotransmitters that send chemicals to the brain if you should eat it or not/ if its toxic or not.

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