

The Food Systems Model Approach and Adapting Didactic Nutrition and Dietetic Instruction to the HyFlex Model

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INTRODUCTION

Teaching strategies that were effective pre-Covid-19 may no longer work. The question posed is if the strategies can be adapted to the HyFlex Model for didactic nutrition and dietetics program. Multiple studies exist on diversifying teaching and learning strategies among various health science programs but are those strategies ineffective post-Covid?¹⁻⁵ Moreover, few studies exist on using the HyFlex Model for higher education.^{6,7} Now more than ever in the post-pandemic world, educators are assiduously trying to improve student grades and increase engagement. Students learn differently, so employing numerous strategies that appeal to multiple learning styles could improve both engagement and achievement in the new semi-virtual classroom.^{5,8-10} Educators can respond to students' varying learning styles by diversifying their teaching strategies.^{5,10,11}

Pre-pandemic, professors were able to create high-impact learning environments to address multiple learning style preferences when they developed and implemented diversified teaching and learning strategies.^{3,5} One study focused on utilizing four different strategies with nursing students and found that diversifying improved students' grades and perception of increased personal and professional growth.² Other studies argued the transition to teaching in-person courses online is not the best methodology.⁷ Conversely, the blended format of in-person and online

learning surpasses the structure of solely in-person or online formats.⁶

Using the HyFlex Model involves alignment of the course with physical and virtual spaces; facilitation of engagement; clear expectations; updated technology; learning environment design; and institutional support.⁷ HyFlex teaching allows students some freedom of choice when it comes to learning in-person, online, or a combination of both.^{6,7,9} By considering students' multiple learning style preferences, the HyFlex Model allows professors to engage students regardless of class size.^{1,9} The student population is increasingly becoming more diverse in learning preferences; this, coupled with the new teaching methodology of the HyFlex Model, creates the need for diversifying instructional approaches.^{6,7,9,12} Diversifying strategies involves teaching that considers the needs of students as individuals rather than groups.¹¹ When implemented appropriately, diversifying strategies can be a powerful approach to meet the individual needs of students in the new blended classroom.^{9,13} The purpose of this study was to determine if the HyFlex Model could create an effective learning environment to address student engagement and perceived academic performance in the post-pandemic era.

METHODS

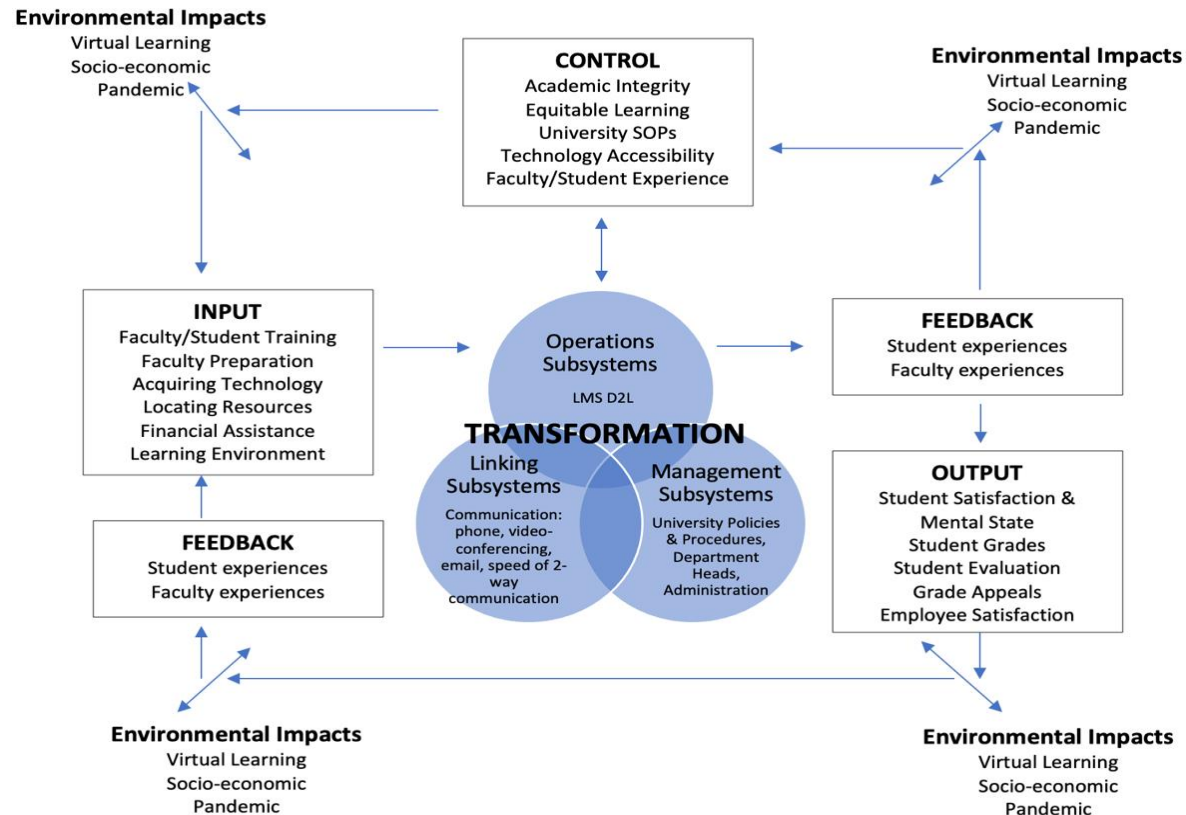
Theoretical Framework

The Food Systems Theory Model is a contemporary methodology to apply management principles and theories to

interrelated subsets of a larger system, analyzing the processes of control, input, transformation, output, feedback, and environmental impacts.^{14,15} Including the Food Systems Theory Model as framework was appropriate because nutrition and dietetics students must be familiar with the

model and know how to apply it. This systems model was adapted specifically for this study based on the results of the study. The study can now serve as an example of the systems model application to dietetic students. See Figure 1.

Figure 1. Systems Theory Model of HyFlex Education



Note. Model was adapted from the Systems Theory Model from previous studies.^{14,15}

Study Design

This study used action-based research (ABR) design consisting of mixed methods research.¹⁶ Utilizing ABR for this study was suitable because in addition to increasing engagement and grades in students, ABR is personally reflective by design.^{17,18} ABR is utilized when a person desires self-improvement or modification of something while participating in the research themselves.¹⁶ By participating in the research, the principal investigator assumes both internal and external roles when the study commences.^{17,18} Utilizing mixed

methods research will contribute to researcher reliability and credibility of the study.¹⁶⁻¹⁸

After approval was granted from the institutional review board, 136 undergraduate nutrition and dietetics students from classes in a nutrition and dietetics didactic program were exposed to five diversified teaching and learning strategies in their courses, aside from traditional methods. Each strategy was designed to appeal to multiple learning styles to engage more students. The

strategies included terminology flash card sorts; anticipation guides; case studies; gamification; and learning in the round. The methodologies were used during class and provided online as supplemental aids to empower student learning. By providing the supplements online, students could take their lessons home and learn independently. Each strategy is explained below, accompanied by HyFlex Model modifications.

Terminology Flash Card Sorts

Two categories of cards are created: terms and definitions. Cards are mixed and students are divided into small groups depending on class size. Groups are tasked with matching terms and definitions; students are encouraged to discuss and analyze each term as they worked toward the goal. The instructor circulates through the groups to listen and keep everyone on task. If the group has a question, they hold up a red card, so the instructor knows to stop. A green card is indicative of the group being finished and ready for a work check. With some students in-person and others online, students in-person will be able to use the original flash cards to sort terms and definitions. Some in-person students will be grouped with students online, and students who were completely online will be given one document with jumbled terms and definitions. One student will share their screen and control the document, and all students will discuss and analyze each term. When the group is done discussing and analyzing, the student controlling the screen and document will begin to cut and paste the terms with group guidance until the entire list is arranged correctly. The instructor's role and in-person and hybrid student groups would operate as they did pre-pandemic; virtual students would be able to use Zoom's Ask for Help feature, alerting the instructor to provide assistance.

Anticipation Guides

Anticipation Guides are prior- and post-learning activities. Anticipation Guides provide students a list of questions, with

“before reading” and “after reading” columns.¹⁹ Individually, students read each question, answering with their current knowledge of the subject matter in the “before” column. After the material is presented, students read each question a second time and provided their answer in the “after” column. Because this type of activity is a learning device rather than an assessment, each student will grade their own work. After grading, students are required to look up the answers they get wrong and record page numbers where the correct information is found. This requires students to engage with textbooks and will provide an additional study guide for later exams. In the HyFlex model, aside from adding a digital format of the guide, the activity would remain the same for in-person and virtual students.

Case Studies

Pre- and post-pandemic, case studies provide in-person and virtual students the opportunity to learn from real-life experiences or theoretical examples based on true scenarios.²⁰ Case studies can be given to students individually or in small groups and are a common learning tool for nutrition and dietetics students throughout their undergraduate curriculum and their dietetic internships. In-person and virtual students are divided into groups of 2-4 students. Students are instructed to read the case study, then discuss its content. Groups answer a list of questions asking about appropriate/correct or inappropriate/incorrect aspects of the situation. Case studies encourage critical-thinking and a more profound level of reasoning as students analyze each right and wrong scenario. If the scenario is correct, students discuss correct versions of the scenarios. Students are asked to offer modifications that could remedy incorrect scenarios.

Gamification

Gamification has been gaining popularity in recent years both in academia and in industry.²² Although many definitions exist

on gamification, commonly it is defined as a systematic way of learning in a constructed format, utilizing games as systems, including conflicting goals, rules, variables, and undefined results to experientially solve problems.²³ The instructor purchased gaming templates to use as the base platform for the interactive digital games.²⁴ Some student favorites include Who Wants to Be a Millionaire, Jeopardy, Family Feud, Connect4, and Baseball. The game show Password and the board game Taboo were adapted into non-digital gamification activities. Escape rooms have gained popularity among the in-person students. Role-play in a foodservice kitchen or menu planning session with a patient are other manual forms of gamification. Gamification addresses multiple learning style preferences; engages students; and works well in the HyFlex Model due to its digital format. Most of the games used in the nutrition and dietetics courses for study purposes and in-class engagement will continue to work as they did pre-pandemic, with minor modifications. Virtual students would be able to participate with in-person students via Zoom and in-person students' personal devices.

Learning in the Round

Learning in the Round is an active learning strategy often used as a prior-knowledge activation tool.^{25,26} This teaching strategy has one minor modification in the HyFlex Model: virtual students will be able to participate with in-person students via Zoom and in-person students' personal devices. In addition to prior knowledge activation, it was adapted to work as an active learning lecture, as well as a post-learning tool. Ten to fifteen critical-thinking questions are created based on the content for a particular lesson and class size. Depending on classroom layout, the questions can be written on easel-size Post-it notes that are stuck to the walls around the room, or on printer paper spread out on desks. The class is arranged into small groups who circulate to each poster for 1-2 minutes. The instructor sets a timer and circulates

around the room to observe the groups. Each group has a small pad of Post-it notes and is instructed to write answers on the sticky side; doing so keeps answers hidden from remaining groups. When the timer goes off, students rotate to the next question. Once students go around the room and return to their original poster, they collect answers and determine the correct one to report out. Guided by the instructor, students discuss each question and answer. This strategy promotes collaboration and allows the instructor to supplement each answer with additional information.

Measure

At the end of the semester, all students were asked to participate in an 18-item post-course survey. The purpose of the survey was explained and 110 consented to participate. The post-course survey was created specifically for this study through the use of Qualtrics®; allowing data to be collected anonymously and digitally. Utilizing Qualtrics® allowed collected data to be stored securely via a secured login. Questions 1-7, quantitative in design, relate to learning styles and how the teaching and learning strategies impacted grades, engagement, and attendance. Questions 8 and 10 were qualitative and open-ended, giving students the opportunity to provide additional responses or perceptions not identified throughout the survey. Utilizing a Likert Scale (least effective to most effective) for question 9, students were asked to rate effectiveness of each teaching and learning strategy utilized throughout the study, as well as rating the overall effectiveness.

Data Collection

In ABR, reliability of data collection requires an unbiased, conscious effort to remain objective.^{18,27} In order to strengthen the data collection process, two other department faculty administered the survey to ensure validity, reliability, and objectivity.^{16,27} To further validate data collected and strengthen findings, data were reviewed with an educational research professional at

the end of the study. The last effort to support the reliability of the study was to conduct a Cronbach's Alpha on the Qualtrics® post-course survey, resulting in a .935 confidence rating. Triangulating multiple data points in ABR added credibility and eliminated bias in the study.¹⁶⁻¹⁸ No demographic information was collected, and the data collection was exclusive to nutrition and dietetics students, excluding anyone who was under 18. There was no risk to participants, and all were able to quit the survey at any point.

Data Analysis

The Likert Scale items in the post-course survey were reviewed and analyzed using descriptive statistics analysis; close-ended questions were analyzed quantitatively. Many students provided responses to the open-ended questions in the post-course survey. A descriptive analysis was used to review the responses identifying key themes. Once common themes were identified, the investigator categorized responses accordingly.

RESULTS

While the results of the study are pre-pandemic, theoretically, the outcomes will remain relatively the same as the strategies are adaptable to the HyFlex Model. Descriptive statistics for nutrition and dietetic student perceptions of academic performance for the 110 participants are presented in Table 1. Most students, (89%) indicated feeling they perform better academically in courses where professors attempt to teach to multiple learning styles. Of the 110 participants, (68%) reported performing better in a classroom where both teacher and student-centered environments are provided. Fifty-three percent of students felt the diversified teaching and learning strategies utilized in this course enhanced their performance compared to other nutrition courses that did not diversify.

Descriptive statistics for student perceptions of engagement and attendance for the 110 participants are presented in Table 2. In

engagement and attendance, most students indicated they agreed or strongly agreed that courses where professors diversified strategies encouraged better attendance and engagement. While a significant number of students rated all strategies effective or most effective, 87% of students preferred gamification as their favored strategy to learn. Terminology flashcards, anticipation guides, and learning in the round were evenly divided. Student perceptions and preferences for each teaching and learning strategy as well as overall perceptions of diversified learning are presented in Table 3.

A descriptive analysis of question 7 outlined common perceptions students had about their experience in a classroom environment that used diversified strategies. While most students did not provide feedback, there were two predominate themes from the 1.2% who did. The first theme was "positive", and students reported enjoying the variety of strategies used throughout the semester. Students mentioned benefits of the diversification as:

- *"More fun."*
- *"Kept things interesting."*
- *"Promoted learning and retention of material."*
- *"Exposed us to new ways to learn that appealed more to our personal learning preferences."*

The second theme was "constructive" and centered on the learning environment. Some students stated they preferred lecture over activities and there were two common reasons:

- *"My classmates were not prepared, so I felt I had to do all the work, therefore I did not learn anything from my peers."*
- *"I feel like I'm paying for my professor's knowledge and expertise, not my classmates who have limited or inaccurate knowledge."*
- *"Group work is not an effective way to learn."*

Table 1. Student Academic Performance

Questions	Yes	No	About the Same as Other Classes
Do you feel a professor who actively teaches to multiple learning styles helps your overall academic performance?	89%	7%	4%
Do you feel a professor who actively incorporates both learning environments; teacher and student-centered helps your overall academic performance?	68%	14%	18%
Do you feel you performed better academically in this course due to the diversified teaching and learning strategies utilized throughout the semester as compared to courses that did not diversify?	53%	9%	38%

Table 2. Student Engagement and Attendance

Questions	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
My attendance improves when a professor diversifies their teaching and learning strategies.	3%	6%	16%	50%	24%
I am more engaged in a class where a professor diversifies their teaching and learning strategies.	2%	3%	7%	49%	39%

Table 3. Teaching and Learning Strategies

	Most Effective	Effective	Neither	Somewhat Effective	Least Effective	No Response
Terminology flash card sorts	18%	47%	11%	13%	6%	5%
Anticipation guides	29%	36%	26%	2%	0%	7%
Case studies	25%	46%	16%	7%	1%	5%
Traditional teaching and learning strategies	27%	38%	14%	11%	5%	5%
Gamification	45%	42%	6%	3%	3%	1%
Peer-to-peer	20%	48%	12%	12%	5%	3%
Collaborative	16%	54%	13%	10%	4%	3%
Learning in the round	25%	44%	9%	12%	7%	3%
Overall perception of diversifying teaching and learning strategies utilized.	22%	65%	4%	7%	0%	2%

Note. The percentages displayed are the rated perceptions of the students for each strategy and diversification overall.

DISCUSSION AND CONCLUSIONS

The purpose of this study was to determine if the HyFlex Model could create an effective learning environment to address student engagement and perceived academic performance in the post-pandemic era. Using the Systems Theory Model as a foundation, the findings from this study were used to create a systems-based model for HyFlex learning. The Systems Model created for this study was adapted from previous experts' models.^{14,15} Student perceptions of diversified teaching and learning strategies were identified. Like other studies, students perceived the teaching and learning strategies helped improve grades.¹⁻⁵ Throughout the study, students were exposed to multiple strategies to appeal to their individual learning styles and increase engagement comparable to other studies.^{3,11}

Conducting this study revealed 89% of students perceived they learned better when multiple learning styles were addressed. Overall, most students had positive perceptions about the impact on their engagement, grades and learning environment. In addition to benefits for students, the instructor was able to

recognize the correlation between empowering student learning by diversifying strategies and an increase in engagement and achievement. By diversifying strategies, instructors can reach every student with every lesson, thereby improving content knowledge as well as course grades. Gauging perceptions about the different strategies helped the instructor gain better understanding of their effectiveness; many students even used the strategies to create their own study tools outside the classroom.

This study only focused on nutrition and dietetic students participating in a foodservice management course. Although the study focused on one classroom environment, this study could lead to future studies isolating classroom environments such as separating the classrooms into in-person and online, which could allow more significant data to be reported. Strategies were successfully implemented with post-secondary students ranging in class-size from 12-123. A follow-up study on the implementation and execution of the new HyFlex teaching and learning strategies could lead to more successful blended learning options.

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