

# “Designing a Mobile Teaching Kitchen”: A challenge based learning experience

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*Abstract– This paper examines how students of the Nutrition and Wellness undergraduate program developed new skills by facing challenges and determining practical interventions for real life situations with the application of the novel Tec 21 Educational Model. To analyze this, a Challenge- Based Learning (CBL) methodology was applied with the partnership of an international collaborator. Collaborative interactions with other classmates and instructors allowed students to develop skills of multidisciplinary, effective communication and solution proposals for real life challenging situations. At the end of the implementation, students were surveyed to evaluate progress and satisfaction, as well as to propose new activities for future applications. Our results showed that the majority of students (≥70%) considered their experience had a positive impact in the development of their abilities to identify opportunities for a social change for the country and to identify entrepreneurship opportunities in the field of nutrition, food services, science and technology. Additionally, more than half the students (55%) considered that the amount of effort they put into the courses was very high and most students (81%) defined it as a hard intellectual challenge. Derived from an educational perspective, this study highlights the favorable outcomes and improvement of future applications of the development of skills for different work fields as a result of the implementation of the Tec 21 Educational Model.*

**Keywords--** Challenge-Based Learning, Multidisciplinary, Nutrition, Professional Education, Education innovation, Higher education.

## I. INTRODUCTION

Technology has changed hastily in the last decades and with this, new skills are needed in the professional field. Nowadays, new professionals might have the skills to get used to different environments and work settings. The traditional educational models are based on lectures covering prescribed academic contents, and studies have shown that according to the learning pyramid, the average retention rate is in the order of five percent [1]. Hence, there is a need to prepare students to continuous change and to develop skills and competencies for the 21<sup>st</sup> century. In that sense, educational models must be renewed, and thus, new teaching methodologies have been considered. Skills such as teamwork, multidisciplinary, oral communication, negotiation, and empathy are necessary for the students to walk into the professional life smoothly. Thus, the learning of students in higher education should focus on the active development of understanding and the ability to apply knowledge to practical situations [2].

Since summer 2019, the Tecnológico de Monterrey has been implementing the Tec 21 Educational Model, whose aim

is to prepare students to face the challenges of a changing and uncertain world and to ensure its graduates' international competitiveness [3]. The model is supported on four fundamental pillars:

- a) Challenge-Based Learning (CBL)
- b) Flexibility
- c) Inspiring teachers
- d) Memorable experience

With these pillars, the students are exposed to real problems as they develop skills to enhance their competitiveness for today's world [4].

CBL shares some characteristics with Project Based Learning (PBL). In both approaches the students participate in the development of the solution to specific problems; however, the CBL offers general, open issues from which students will determine the challenge they will address, rather than receiving a problem to solve [5]. The objective in CBL is to develop competencies that might be tangible in the solution to the challenge rather than to solve the problem itself. The underlying principle of CBL is that the students learn better when they participate in experiences. Therefore, the students apply what they learn in a real situation, where they face problems, interact with other students, and discover by themselves a practical intervention in a certain contexts [6].

Chronic undernutrition continues to be a prevalent issue in the Mexican population [7], and on behalf of this problem which is also present worldwide, the students collaborated with the SF for the development of a mobile teaching kitchen, an initiative of the SF to empower communities by teaching them culinary skills and providing knowledge through nutrition education to enhance the health and wellbeing of vulnerable and working communities of women, children and families [8]. The SF provided education sessions and training to the students to transfer their own experience so that along with the implementation of the Tec 21 educational model, the students could be able to develop a mobile teaching kitchen for marginalized communities in Mexico. Besides the development of a MTK, students also were guided to come up with a healthy snack to have in the MTK that included a functional food.

On account of the above, this paper presents the results of the implementation of the Tec 21 Educational Model in the Nutrition and Wellness undergraduate program in junior students. The students were linked up with an international renowned organization, called educational partner (SF), to work on the development of a mobile teaching kitchen that would promote the development of job skills to face real challenges in the future fields of work.

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## II. METHODOLOGY

### A. *Challenge-Based Learning (CBL) Methodology*

Applying challenge-based learning (CBL), the teaching team selected an international partner to work with. Three courses (UF) of the 3<sup>rd</sup> year of the Nutrition and Wellness program were involved: Food Service Management, Food Science, and Food Technology. Four or five students were teamed up to work applying the knowledge acquired. The students worked on solving three challenges:

- a) Designing a mobile kitchen
- b) Diet for a sustainable planet and
- c) Food for the future: Innovation in Functional Foods and Probiotics

Each challenge lasted five weeks and had the participation of students from three Campi of the Tecnológico de Monterrey (Monterrey, Guadalajara, and Mexico City). The projects were evaluated considering four components:

- a) progress reports
- b) food recipes and formulations
- c) a short presentation
- d) an oral presentation for the SF

### B. *Collaborative Interactions*

There were three types of instructors:

- a) the tutor responsible for guiding students in the solution of the challenge and evaluating competences
- b) theory instructor in charge of the theoretical framework relevant to the challenge
- c) practice instructor overseeing the labs and practices relevant to challenge. The students had theoretical lessons via Zoom and went to the food laboratories for the practices for the challenge. Moreover, synchronic zoom meetings were held with the SF to answer questions and receive feedback, and team members were in communication through WhatsApp, Zoom, and Google Drive.

### C. *Educational sessions with the SF*

The students participated in collaborative sessions with the international SF in 3 occasions in each of the 3 courses of the semester. During these sessions, students were presented with the concept of the MTK and the steps to implement it. Hence, the students proposed a project to implement the MTK to a marginalized community in their context. At the end, groups of students competed among themselves for the best proposal project, which was chosen by the instructors.

The international partnership with the (SF), offered the students the opportunity of having one on one live feedback sessions in which they, along with members of the international (SF), assessed the nutrition and health status of vulnerable communities in Mexico. These interactions served as real live experience of working in international environments with multidisciplinary teams. Through out these sessions, the students had the opportunity to do research and apply dietary

knowledge while developing culinary skills and gaining food science and technology experience.

These experiences allowed them to come up with a project proposal for the communities where they were planning to have a nutrition intervention. Additionally, each 5 week period the (SF) gave a talk specially designed to tackle the challenge the students were facing, increasing the interaction between them and broadening their understanding of the issue.

To put into practice the Educational Model of Tec 21, 3 Challenge-Based Learning courses were implemented using the MTK project as a model for a real life problem. The courses gave the students the opportunity to come up with a proposal for a challenging real life situation in the field of food science and nutrition.

Through out the semester, the students gained memorable experiences by working with an international (SF); the variety of educational tools and resources used by the teachers and tutors amounted to the whole integral experience.

In addition to the knowledge and innovation experience the students acquired during the semester while designing the MTK model for the Mexican population, they also came up with additional food innovation projects that could provide extra health benefits. These projects, which should also be produced inside the MTK, were linked to the courses and had specific requirements to meet the needs of the different communities

Furthermore, to encourage a competitive spirit, the best MTK proposals and functional food innovation projects were chosen by the instructors at the end of the 3 courses (Fig. 1, Fig. 2), increasing the students motivation to learn and succeed in their challenges.

### D. *Survey of Student Progress and Satisfaction*

Throughout the collaboration with the SF, the students were surveyed in relation to satisfaction with the activities, professors, and interactions with the SF. In these surveys, they were also given the opportunity to propose new ideas for activities and improvement for future collaborations.



Fig. 1 Culinary proposal of a team of students with emphasis in the mexican cultural eating habits with the use of healthier version of ingredients than the original dish.



Fig 2. Culinary proposal of a team of students with emphasis in the development of a functional food snack with the use of healthy ingredients.

### III. RESULTS AND DISCUSSIONS

A short survey was handed out to the students at the end of the 3 courses to evaluate their learning experience.

The survey contained multiple choice questions as well as open ended ones, it was sent via e-mail to all 70 students who took the 3 courses (UF) in the 3 campi, 38% of the students completed the survey in time and thus were taken into consideration for the analysis.

A total of 19 students (70%) considered that their experience working with an international educational partner (SF) had an positive impact on their abilities to identify opportunities for social change in the country (Fig. 3).

Two talks given by the educational partner (SF) “Designing a Mobile Teaching Kitchen: the experience in India” and “Sustainable Food Production” had a strong focus on social development and change in communities around the

world, these concepts helped to foster the desire for social change in the students by showing them real live examples on how certain nutrition challenges have been solved or are being handled in other parts of the world.

Additionally, 21 (77%) of students indicated that their interaction with the (SF) had a positive impact in their abilities to identify entrepreneurship opportunities in the field of nutrition (Fig 4), furthermore, 70% of them agreed that their experience with the (SF) had a strong impact on their ability to develop new projects related to food services, science and technology (Fig. 5), both competences were strongly supported by the Food Technology challenge and by the talk given by the educational partner (SF) “ Functional Foods: regulations and applications” were the students learned about the food innovation process regarding functional foods in Europe. This talk, in addition to the interaction with the educational partner ( SF) helped them see how food projects were carried out and developed in other countries, and had a strong impact on how they thought about innovation and food development and design.

When asked about what they considered to be the most valuable learning from working with an international educational partner (SF), 19 (70%) of the students agreed that “learning about specific nutrition issues from other countries” was the most valuable intake.

Everytime the students interacted with the educational partner (SF) through the talks organized by them or the feedback sessions scheduled to talk about their projects, the students gained valuable insight on how certain nutrition issues were handled in other countries. The strongest impact came from the live one on one feedback sessions, were several members from (UF) paid close attention to the student’s projects and shared very specific recommendations on how to improve them.

The interaction the students had with nutrition professionals from other countries was a real life experience which broadened their understanding on certain nutrition issues and gave them the opportunity to learn how projects are handled outside of their country.

#### A. Effort, Intellectual Challenge and Motivation to Learn

According to the Music Model of Motivation which contemplates incorporating strategies designed to increase the Empowerment, Usefulness, Success, Interest and Caring (Importance of the teacher to the student) of the courses, the level of effort the students put into a course and the intellectual challenge presented by the courses are fundamental to increase the intrinsic motivation of the students to learn, thus giving them the opportunity to succeed in a complex situation [9]. Consequently, it was really important to measure the effort and intellectual challenge perceived by the students during the semester, additionally, since the educational model is

Challenge-Based Learning, it was vital that the students found the courses challenging.

The magnitude of the effort the students had to put into the courses and the intellectual challenge the courses represented to them were evaluated using a scale from 1 to 5, where 1 was very low and 5 was very high.

Out of the 27 students who took the survey, 55% of them considered that the amount of effort they had to put into the courses was very high (Fig. 6) and 81% of them rated the courses as very high intellectual challenges (Fig. 7).

These two answers show us that the courses were challenging and that the students had to strive to succeed, which according to the Music Model of Motivation increased their intrinsic motivation to learn by solving a complex problem.

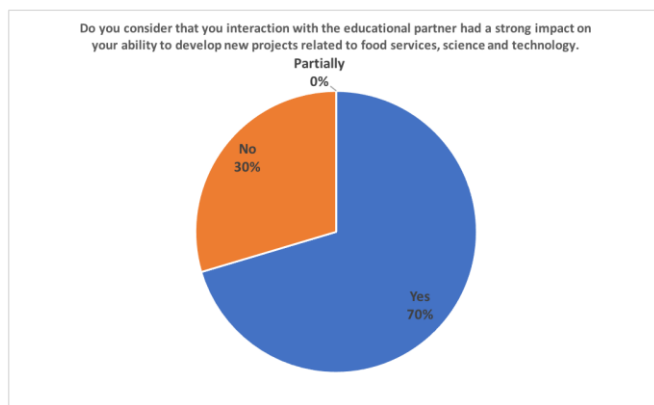


Fig. 5. 70.4% of the students considered that their interaction with an international (SF) had a strong impact in their ability to develop new projects related to food services, science and technology.

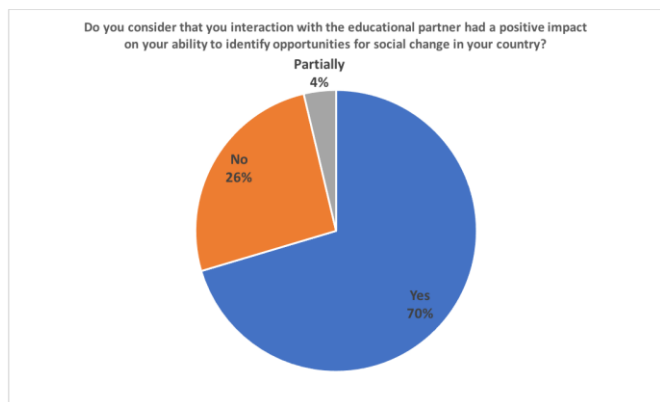


Fig. 3. 70.4% of the students considered that the experience of working with an international (SF) had an impact on their abilities to identify opportunities for transformation in the country.

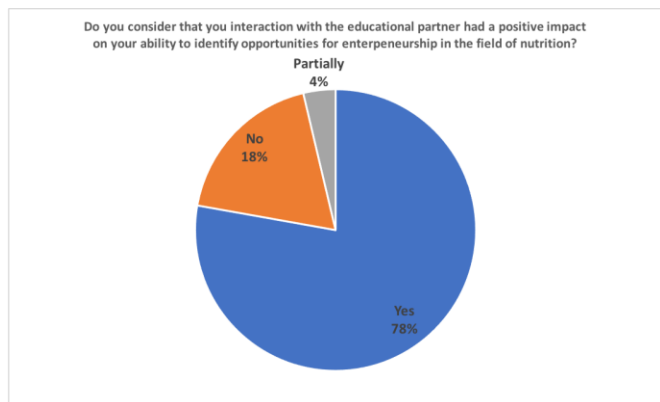


Fig. 4. 77% of the students answered that their interaction with the international (SF) had a positive impact in the abilities to identify entrepreneurship opportunities in the field of nutrition.

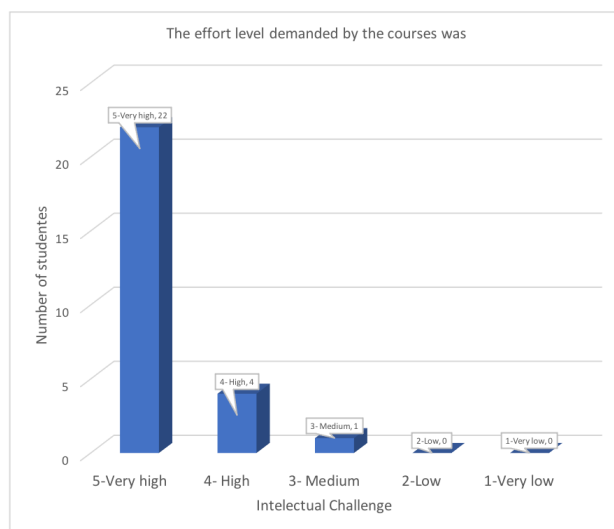


Fig. 6. The effort level was evaluated using a scale from 1 to 5, where 1 was very low and 5 very high.

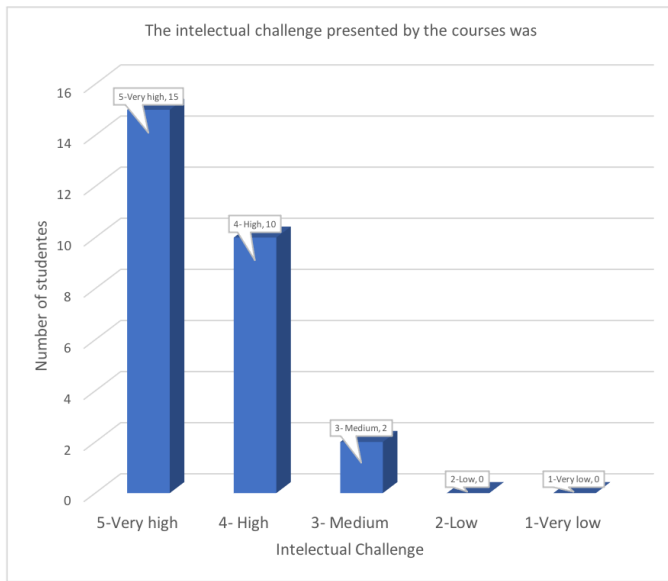


Fig. 7. T The level of intellectual challenge presented by the courses was evaluated using a scale from 1 to 5, where 1 was very low and 5 very high.

The learning resources used during the semester were also evaluated in their value as learning tools for the students.

The most valued educational resources were practical lab practices 48%, followed by live feedback sessions with the International Educational Partner (SF) 18% and close guidance given by the tutor 7.8%. (Fig. 8).

The variety of learning resources -talks given by the (UF), tutoring hours, lab practices, feedback sessions with the (UF), lectures, bibliographic reviews, live workshops given to the communities, design of educational material and homeworks-used during the semester gave students with different learning styles the opportunity to find what worked better for them. It is interesting to note that the least favored educational tool by the students was the use of traditional Homework (0%), which could be an indicator that the students do not see it as valuable when compared with other educational tools.

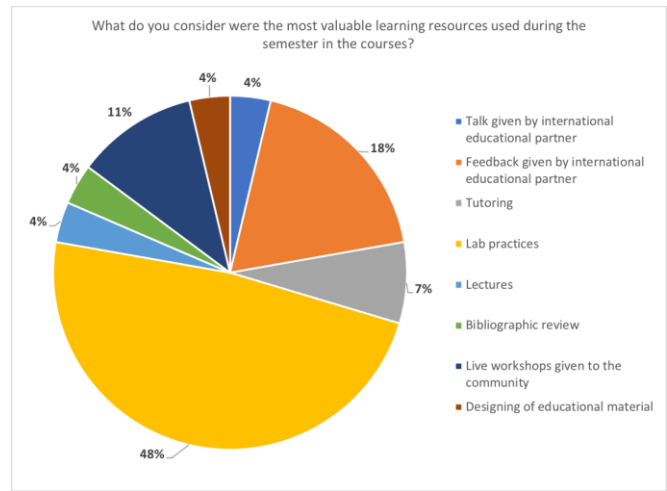


Fig. 8. The most valued learning tools by students were Practical Lab Practices 49%, Live Feedback given by the international (SF) 18% and guidance given by the tutor 7.8%.

When asked about the specific impact the international educational partner (SF) had on their learning experience, the most cited answer was “the benefit of the multicultural classroom” where not only were the students learning from an international organization, but they were also learning to talk about their own culture and traditions in different settings.

In addition to the multicultural experience many of the students cited as valuable: the experience they gained at starting and presenting their own projects, the experience given by working with a real-life problem, the experience gained at starting and presenting their projects, the live feedback received every time they presented their projects to the international (SF) and the experience of practicing a language in which they were not native speakers.

These answers rest at the core of what was the most valuable learning the students gained from working with an international (UF), these learnings could not be gotten through traditional educational practices and thus were unique to Educational Model of Tec 21, the Challenge-Based Learning and the constant interaction with the (SF).

Moreover, when the students were asked about what they would change for future courses, many of the students said that they would increase the number of interactions they had with the international (SF) which is a clear indication that the students found the interactions with the international (SF) valuable as part of their learning process.

#### IV. CONCLUSIONS

The educational model based on Challenge-Based Learning and collaborative interactions proved to be a great way to introduce nutrition students into real life challenges, increase their international competences and their overall ability to work in multicultural settings.

The role of the professor changes to a facilitator during the development of the challenges, where he not only teaches a lesson but monitors activities, reviews team's progress and guides the students into solving the challenge by asking trigger questions.

The interaction with the international (SF) had a positive impact on their student's abilities to identify opportunities for social change in their country and start their own nutrition entrepreneurship projects which broaden their perspectives of their own career and goes beyond learning food science and nutrition concepts in the traditional way.

Additionally, the collaborative interactions and the multiple activities led by the international (SF), the lab practice instructors and the tutors accounted for a rich and varied learning experience.

Given the impact the international (SF) had on the student's learning experience it would be interesting to increase the number of interactions between the students and the international (SF) in future courses.

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#### REFERENCES

- [1] K. Letrud, "A Rebuttal of NTL Institute's Learning Pyramid," *Education*, vol. 133, no. 1, pp. 117–124, 2012, [Online]. Available: <http://proxy1.nyu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ejh&AN=79777067&site=eds-live>.
- [2] E. J. Arrambide-Leal, V. Lara-Prieto, R. M. Garcia-Garcia, and J. Membrillo-Hernandez, "Impact of Active and Challenge Based Learning with First Year Engineering Students: Mini Drag Race Challenge," *Proc. 2019 IEEE 11th Int. Conf. Eng. Educ. ICEED 2019*, pp. 20–25, 2019, doi: 10.1109/ICEED47294.2019.8994939.
- [3] "Modelo Educativo," 2018.
- [4] J. Membrillo-Hernández *et al.*, "Challenge-based learning: The case of sustainable development engineering at the Tecnológico de Monterrey, Mexico City Campus," *Int. J. Eng. Pedagog.*, vol. 8, no. 3, pp. 137–144, 2018, doi: 10.3991/ijep.v8i3.8007.
- [5] W. B. Gaskins, J. Johnson, C. Maltbie, and A. Kukreti, "Changing the Learning Environment in the College of Engineering and Applied Science Using Challenge Based Learning," *Int. J. Eng. Pedagog.*, vol. 5, no. 1, p. 33, 2015, doi: 10.3991/ijep.v5i1.4138.
- [6] J. Membrillo-Hernández, M. J. Ramírez-Cadena, M. Martínez-Acosta, E. Cruz-Gómez, E. Muñoz-Díaz, and H. Elizalde, "Challenge based learning: the importance of world-leading companies as training partners," *Int. J. Interact. Des. Manuf.*, vol. 13, no. 3, pp. 1103–1113, 2019, doi: 10.1007/s12008-019-00569-4.
- [7] M. A. González Block *et al.*, "Retos a la Encuesta Nacional de Salud y Nutrición 2017," *Salud Publica Mex.*, vol. 59, no. 2, pp. 126–127, 2017, doi: 10.21149/8214.
- [8] L. Buckner *et al.*, "'Bhavishya Shakti: Empowering the Future': Establishing and evaluating a pilot community mobile teaching kitchen as an innovative model, training marginalised women to become nutrition champions and culinary health educators in Kolkata, India," *BMJ Nutr. Prev. Heal.*, vol. 4, no. 2, pp. 405–415, 2021, doi: 10.1136/bmjnp-2020-000181.
- [9] B. D. Jones, *Motivating students by design: Practical strategies for professors*. 2018.