

Impact of food orientation and education strategies on meaningful learning of public servants

Impacto de las estrategias de orientación y educación alimentaria en el aprendizaje significativo de servidores públicos

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Abstract

In order to bring social programs closer to the vulnerable population, having food orientation and education strategies in the public social assistance sector is a key task. For this reason, several training sessions have been held for public servants in charge of food programs at the state level, with the aim of contributing to the development of new healthy eating habits that will have an impact on improving the nutritional status of the undernourished and malnourished population. This research was conducted with a quantitative, longitudinal, descriptive and nonexperimental approach [Hernández et al., 2014; and Bernal, 2016] and a census was conducted. The instrument was validated by expert judgment, including five food issues. The main finding, after applying the measurement instrument [pretest and posttest] to 125 trained public servants, shows the impact on the significant learning achieved.

Resumen

Contar con estrategias de orientación y educación alimentaria en el sector público de asistencia social, es una tarea medular para el acercamiento de los programas sociales a la población vulnerable. Por ello, se impartieron diversas capacitaciones a servidores públicos encargados de los programas alimentarios a nivel estatal, a fin de contribuir en el desarrollo de nuevos hábitos alimentarios saludables que incidan en la mejora del estado nutricional de la población con carencia alimentaria o desnutrición. Esta investigación se efectuó bajo un enfoque cuantitativo, de corte longitudinal, de tipo descriptivo y no experimental [Hernández et al., 2014; y Bernal, 2016], y se realizó un censo. El instrumento se validó por jueceo de expertos, incluyendo 5 temas alimentarios. El principal hallazgo, tras ser aplicado el instrumento de medición [pre-test y post-test] a 125 servidores públicos capacitados, muestra el impacto en el aprendizaje significativo logrado.

Impact of food orientation and education strategies on meaningful learning of public servants			
Goals <ul style="list-style-type: none"> Measure meaningful learning achieved by trained public servants Identify the impact of the training achieved 	Method	Research type <ul style="list-style-type: none"> Quantitative Descriptive Nonexperimental Longitudinal study 	Census <ul style="list-style-type: none"> N = 125 people
		Data analysis and hypotheses testing <ul style="list-style-type: none"> Descriptive statistics SPSS Statistics 25 	
		Measure instrument <ul style="list-style-type: none"> Five variables Expert judgment Cronbach's Alpha 	
Findings <ul style="list-style-type: none"> Meaningful learning of public servants > 5% Significant relationship of the FGES with the SLSP at the state level. 		Contribution <ul style="list-style-type: none"> Validation of measure instrument (pretest and posttest) and measure meaningful learning achieved. 	

Impacto de las estrategias de orientación y educación alimentaria en el aprendizaje significativo de servidores públicos			
Objetivos <ul style="list-style-type: none"> Medición del aprendizaje logrado por la capacitación a servidores públicos. Identificación del impacto logrado tras la capacitación. 	Método	Tipo de investigación <ul style="list-style-type: none"> Cuantitativa Descriptiva No experimental Estudio longitudinal 	Censo <ul style="list-style-type: none"> N = 125 personas
		Instrumento de medición <ul style="list-style-type: none"> Cinco variables Jueceo por expertos Alfa de Cronbach 	Análisis de datos y prueba de hipótesis <ul style="list-style-type: none"> Estadística descriptiva SPSS Statistics 25
Resultados <ul style="list-style-type: none"> Aprendizaje significativo de servidores públicos > 5% Relación significativa de la FGES con el SLSP a nivel estatal. 		Contribución <ul style="list-style-type: none"> Validación del instrumento de medición (pre-test y post-test) y medición del aprendizaje logrado. 	

Training on food issues, Quantitative study, Public sector

Capacitación en temas alimentarios, Estudio cuantitativo, Sector público

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1. Introduction

The public sector responsible for social assistance has a fundamental task of utmost importance in implementing food programs at the state level properly: creating food education and guidance strategies. First, these strategies must be aimed at the public servants in charge of these programs, who, in addition to being knowledgeable about food issues, are key to successfully changing the eating habits of the vulnerable population, as the ultimate beneficiaries. These strategies contribute to the empowerment of beneficiaries by providing them with basic knowledge about food and skills that influence healthy decision-making through proper nutrition.

Within food guidance and education, the concept of assistance has shifted from a passive beneficiary population, which only received support without any additional commitment, to an active population that is part of the citizen participation approach. Thus, the beneficiaries of food programs are directly responsible for changing their eating habits, with a focus on the constant improvement of the nutritional status of each individual suffering from food deprivation or malnutrition. In this regard, this document presents an assessment of the significant learning achieved after training on food issues, considering the initial and final evaluations in accordance with the provisions of the descriptive letters for each topic taught in the food programs.

However, the technique used in this research has added value in relation to other techniques such as qualitative research, given that the research was conducted using a quantitative, longitudinal, descriptive, and non-experimental approach [Hernández et al., 2014; and Bernal, 2016], and was applied to 100% of those responsible for food programs in the 125 municipalities of the state in which the research was conducted. The quantitative method has advantages over other methods in that it allows for the obtaining of numerical, objective, reliable, and comparable results. Furthermore, in this case, a census was conducted, making it possible to generalize the behavior of the population.

The problem to be solved with this research is to contribute to the development of healthy eating habits among the beneficiary population, which will improve their nutritional status.

This will be achieved by providing basic knowledge on various topics related to food guidance and education in order to empower beneficiaries to make healthy decisions through proper nutrition.

To this end, the research question is: What is the impact of implementing food guidance and education strategies on the meaningful learning of trained public servants?

The central hypothesis is:

- H_0 : The implementation of the food guidance and education strategy [FGES] by a state social assistance institution does not impact the meaningful learning of trained public servants [MLSP].
- H_a : The implementation of the food guidance and education strategy [FGES] by a state social assistance institution has an impact on the meaningful learning of trained public servants [MLSP].

This research article consists of nine sections, which are described below to clarify and explain the content of each section in general terms. The first section presents an introduction to the research topic, emphasizing the problem to be solved, the central hypothesis, the added value of the technique used, and the general aspects of the research. The second section presents a review of the literature and provides an overview of the theory underpinning the research, referring to the food landscape in Mexico, the assessment of eating habits as an essential element of dietary guidance, educational strategies, and meaningful learning.

The third section details the method used, the type and design of the research, the description of the variables, the measurement instrument, the participants, the procedure, and the techniques for data analysis. The fourth section includes the results and discussion, with descriptive statistics, as well as the discussion in light of the supporting theory described in the state-of-the-art review according to the scientific method.

The fifth section contains the conclusions and recommendations, presenting the main results, limitations, and future work. The sixth section includes the appendices, which show the instrument used, with the items applied for the development of the research.

Section seven includes statements on conflicts of interest, authors' contributions, availability of data and materials, funding for the research, and acknowledgments to the participants, public servants responsible for implementing food programs in the state, and the state social assistance institution that allowed the evaluations for this research to be carried out. Section eight lists the abbreviations used in this article.

Finally, the ninth section lists the references of the authors who have directly contributed to this study according to the literature review: background, rationale, support, differences, and discussions.

2. State of the art review

2.1 Food situation in the country

Despite having a long history of programs and policies aimed at improving the nutrition of the most vulnerable population, Mexico still faces a major challenge in terms of public health for this population. However, the future is encouraging, both in Mexico and worldwide, as there are comprehensive programs that address education, health, nutrition, and development simultaneously, as well as community participation in the planning, monitoring, and evaluation processes [Barquera et al., 2001].

However, cultural, social, and economic diversity in Mexico marks differences in nutrition, which, although it covers a physiological need, is not the same for everyone.

For example, diverse access to food, in terms of production, distribution, and purchase, as well as cultural accessibility, has nutritional and epidemiological consequences that call for an explanation of these phenomena [Bertran, 2010].

Article 4 of the Political Constitution of the United Mexican States establishes that: "Every person has the right to nutritious, sufficient, and quality food.

The State shall guarantee this right." This contributes to Sustainable Development Goal SDG 2: "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture."

Therefore, in order to achieve sustained development, the conditions of inequality that are so marked in the population must be minimized, given that food is conceived as a basic physiological need and, until this is ensured, it will not be possible to speak of a developed country. Thus, according to the Food and Agriculture Organization of the United Nations [FAO], the following conditions must be met in order to achieve food security: physical availability of food; economic and physical access to food; utilization of food; and stability over time of the other three dimensions [Acosta, 2017].

Consequently, there is research proposing that governments should be responsible for promoting access to a nutritionally balanced, safe, and culturally acceptable food basket, as well as encouraging sports and educational institutions that promote good eating habits [Castañeda-Sánchez et al., 2008]. Thus, in order to achieve food security for the Mexican population, it is necessary to redesign food production and social policies and strategies, strengthening institutional governance mechanisms with the participation of all in order to ensure sufficient, stable, safe, and sustainable food availability [Urquía-Fernández, 2014].

In this regard, it is worth mentioning that Mexico has neglected food production, which has repercussions on the complex and multifactorial problem of food security, attributed to the economic, energy, and financial crises, the effects of climate change, water scarcity, and the concentration of power in the markets [Soria & Palacio, 2014].

However, food assistance programs in Mexico have historically focused on mitigating the nutritional deficiencies of vulnerable groups. Nevertheless, nutritional epidemiological changes must be taken into account to ensure that these programs do not contribute to the development of overweight and obesity.

For this reason, it is recommended that food programs be evaluated taking into account poor nutrition and culture, in order to promote social policies for sustained economic growth, equitable income distribution, clean water, healthy food, nutritional education, and health and nutrition services for all [Morales-Ruán et al., 2013].

Not to mention that hunger is a problem in most developing countries, affecting the well-being and progress of their populations.

The problem is mainly detected not so much by the lack of food, but by the way it is distributed [Salazar, 2016]. In this same context, Mexico evaluated the Food Support Program and the Crusade Against Hunger, which sought to improve the diet and nutrition of families, obtaining a rating of 8 out of 10 in terms of their performance. However, due to its limited coverage, it was found that this program left out the vast majority of the population living in extreme poverty, given the insufficiency of resources allocated to support households.

The intensity of relative poverty is greater in households with children, as is absolute poverty. The former refers to the gap between the income households need to stop going without food [Huesca et al., 2016].

A global challenge is to achieve food security, particularly in developing countries such as Mexico, where development is unsustainable due to population growth, low income levels, and rapid urbanization. As a result, a high percentage of the population does not have sufficient income to purchase basic food items and therefore suffers from nutritional insecurity [Aguirre et al., 2017]. In the same vein, achieving food security remains a challenge affected by poverty and hunger despite the implementation of policies and plans to combat these issues over the last four decades [López & Sandoval, 2018].

Even though there are public sector food programs aimed at providing sufficient quantities of food to vulnerable populations such as indigenous and rural communities, children, and women, Mexico continues to have alarming rates of overweight and obesity, which contribute to chronic diseases due to hunger, micronutrient deficiencies, high-energy diets, poor food quality, and misinformation among the Mexican population [Aguirre et al., 2017].

About Food Aid Programs [FAP] in Mexico, it can be said that these are present in 44% of households, with the highest concentration in indigenous households [70%], those with very low socioeconomic status [70%], and those experiencing moderate to severe food insecurity.

In this regard, it is necessary to review the resources of these programs and target them at populations with greater needs and nutritional vulnerability [Morales-Ruán et al., 2018].

Food insecurity persists in Mexico, given that one in five households with the greatest deprivation suffers from this public health condition. In this regard, comprehensive action by the State is needed to strengthen economic access for this population [Shamah-Levy et al., 2021].

It is worth mentioning that problems continue to exist in terms of access to and availability of food for the Mexican population, as well as the replacement of traditional diets, which have been affected for more than four decades by the introduction of new products, mainly due to the signing of the North American Free Trade Agreement [NAFTA] in 1994. As a result, Mexicans have replaced their corn and bean diets with countless high-calorie products, which affects public health with the incidence of overweight and obesity [Sandoval et al., 2025].

It should also be noted that over the last four decades, more than half of the Mexican population has fallen into poverty and vulnerability, suffering from shortages in food, housing, education, and/or health care [Ortega-Marín & González-Rosas, 2023]. In addition, food consumption decisions in rural areas are restricted by the physical and geographical conditions of the territory, such as topography and transport networks [Ríos-Llamas & Tapia-Galindo, 2024].

On the other hand, public food policy in Mexico is extremely limited. Since 1940, it has focused on availability and access, while since 1980 it has focused on achieving access for sectors of the population with extreme needs. Therefore, it seems that this issue does not concern the Mexican State, because it is only partially addressed [Arellano-Esparza, 2022].

However, on April 17, 2024, the General Law on Adequate and Sustainable Food [GLASF] was enacted, representing a new public policy on food and nutritional security in our country. It focuses on ensuring that all Mexicans have access to nutritious, sufficient, and quality food. It also aims to change the Mexican food system, from the equitable distribution of food to food education.

This is a major step forward, but it represents a challenge both in terms of resource allocation and coordination between public institutions [Ortega-Ibarra et al., 2025] and society in order to implement it successfully.

Finally, in order to understand the food landscape in the country, it is necessary to understand the relationships between all those involved, from institutions and social actors to the population itself, as well as beliefs, practices, knowledge on food issues, and food consumption choices to satisfy mainly physiological needs, the direct impact of which is reflected in the quality of life of the Mexican population [Sandoval et al., 2025].

2.2 Assessment of knowledge and eating habits

At a university in San Pablo, Madrid, Spain, an assessment was carried out on 105 students from various degree programs in nursing, pharmacy, human nutrition and dietetics, and podiatry, who had taken the Nutrition and Dietetics course for one year.

These students completed a dietary record and a questionnaire on their knowledge, eating habits, and lifestyles, as well as their weight and height. This study concluded that having knowledge about nutrition does not imply changes in the diet of those who possess it, nor in healthier lifestyles [Montero et al., 2006].

At a secondary school in Mexico, the eating habits and nutritional status of adolescents were assessed. When the questionnaire was completed, it was found that statistically, eating habits are not related to nutritional status. However, when eating habits are clinically deficient, adolescents present problems of malnutrition, overweight, and obesity [Castañeda-Sánchez, et al., 2008].

In Spain, the Food and Nutrition Education Program [FNEP] was evaluated. It included messages and strategies for food and nutrition education aimed at housewives to improve their skills, as they are responsible for the well-being of their families, especially in relation to food and nutrition, which was corroborated [Trescastro et al., 2012].

In Mexico, the school program “Play and Food Bring Health to Your Life” was evaluated. It was implemented in public elementary schools as a useful strategy for modifying habits in elementary school children to reverse childhood obesity and overweight, as well as chronic degenerative diseases among children in Mexico. It was found that changing behaviors requires coordinated actions both inside and outside the school with all stakeholders in the education sector, promoting actions based on the adoption of a healthier lifestyle [Niembro & Sosa, 2013].

A study was conducted in Paraguay to assess the level of knowledge and eating habits after training household heads in dietary guidelines, taking into account socioeconomic data and dietary education classified into knowledge, attitudes, and practices in urban and rural areas. It was found that heads of households from both areas increased their knowledge in a similar way, and that there was a significant increase among groups, modifying dietary habits and reducing the consumption of non-recommended foods [Villalba & Dávalos, 2013].

At the University of Castilla La Mancha in Spain, a study was conducted on the diet of the university population, finding that it is of poor quality, with 90% needing to make changes towards a healthier eating pattern. Nutritional education is suggested as an essential tool to achieve this [Cervera et al., 2013].

In Ecuador, they reviewed their food programs and suggest that a food and nutrition policy requires up-to-date, high-quality, disaggregated information in order to respond to various interventions in different territories. Therefore, it is crucial to have monitoring systems, mechanisms, and instruments that allow decision-makers and operators to know whether goals and results are being met, in order to reorient if possible [Salazar, 2016].

In Peru, the eating habits of medical students at the University of San Martín de Porres were evaluated, and it was found that most skipped breakfast and consumed fast food. Therefore, it is suggested that universities intervene to promote nutrition education and implement strategies such as providing healthy breakfasts [Torres-Mallma, et al., 2016].

In Chile, a quasi-experimental study was conducted with qualitative measurements of 43 teachers and quantitative measurements of 302 students from three schools in the La Reina community in Santiago, Chile.

The teachers were trained and then developed an action plan, successfully changing eating habits and consumption, increasing fruit and water consumption, and improving the way sandwiches were prepared [Fierro et al., 2019].

A study conducted among students in Argentina, given the prevalence of overweight and obesity, found that it is important to implement training programs in schools and in the community in order to promote healthy eating and physical activity to prevent chronic diseases [Horna et al., 2018]. A study of 500 university students in Ecuador also concluded that students' willingness to prepare their own meals affects their satisfaction with their food consumption [Lapo et al., 2019].

In Peru, an educational strategy was developed to contribute to improving the eating habits of secondary school students with the aim of involving and empowering the educational community in food culture, eating habits, and nutritional health [Velázquez et al., 2021].

In Mexico, an early educational intervention was carried out targeting 50 housewives in the central area of Tamaulipas, giving three presentations on selected topics related to food and nutrition and two practical workshops. The results showed that the total number of participants increased their knowledge of healthy eating habits by 14%, which will contribute to a healthier lifestyle [González-Hinojosa et al., 2022]. Currently, 59.1% of families in Mexico do not have sufficient economic resources to obtain food that is adequate in quality and quantity. Food insecurity leads to high human, social, and economic costs in Mexico, as it is highly correlated with loss of productivity, high rates of poverty and marginalization, poor use of human potential, and social exclusion, with greater emphasis on the country's indigenous and rural communities [Ayala, 2024].

Consequently, food security conditions in Mexico reflect an urgent need for education and awareness campaigns to improve the population's eating habits, which will help reduce problems of malnutrition, overweight, and obesity [Acosta, 2017].

In Colombia, qualitative research was conducted to analyze how scientific skills learned in school influence students' food choices. It was found that learning environments focused on inquiry, scientific research, and critical understanding of scientific knowledge enable the development of skills to analyze, question, and propose nutritional alternatives, linking science with everyday life [Ramos, 2025].

In Panama, research was conducted on children and adolescents in a children's home, confirming that nutrition education is a fundamental tool for promoting healthy habits, such as knowledge of a diet rich in probiotics and prebiotics, which helps fulfill various vital functions of the body, such as disease prevention and promoting intestinal health. as a longitudinal study was conducted in which, after the educational intervention, the knowledge of the study population improved [Bonilla & Caballero, 2025].

Finally, in the same vein, a study was conducted in Colombia with a view to corroborating the need to improve students' eating habits and develop strategies for nutrition and physical activity, highlighting concerns about students' physical, academic, and emotional well-being and the lack of relevant strategies, leading to the development of the proposal "Sowing Healthy Habits" [Leal, 2025].

2.3 Meaningful learning

The theory of meaningful learning proposed by Ausubel et al. [1976] states that learners acquire new knowledge based on prior knowledge, which allows them to interrelate what they have learned with what they are about to learn, unlike rote learning. This theory considers learning to be a process that occurs when new knowledge or information is related to the prior knowledge [cognitive structure] of the learner in a non-arbitrary and substantive way, based on the anchoring of relevant ideas or aspects [Guamán & Venet, 2019].

Likewise, this theory goes beyond traditional learning of a change in the individual's behavior to a change in the meaning of their experience. In this sense, there are several elements that affect people's learning. First, there are teachers and their teaching methods. Second, there is the structure of the curriculum's knowledge and how it is produced.

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Third, there is the social context in which learning takes place during the educational process [Ausubel, 1983].

The theory of meaningful learning emerged during the rise of constructivism, as a response to behaviorism, where activism and discovery learning were strong [Ordóñez & Mohedano, 2019]. However, this learning can occur through both reception and discovery.

According to Ausubel [2000], it is classified as: representational learning, in which meaning is attributed to certain symbols without defining attributes; concept learning, defined as common objects, events, situations, or properties that characterize a sign or symbol; and propositional learning, in which there are combinations of words in sentences that represent concepts.

Meaningful learning [Ausubel et al., 1976] is defined as a process whereby new information is integrated directly, non-arbitrarily, and substantively into the learner's cognitive structure. This theory has two important elements: non-arbitrariness and substantivity. In the first case, non-arbitrariness refers to the fact that new knowledge is not related to just any knowledge, but rather to the most relevant cognitive structure, known as the cognitive substructure. The cognitive structure, known as subconsumers. This means that relevant prior knowledge becomes an anchor for new knowledge and facilitates its retention.

To do this, it is important to understand that learners start from their own cognitive structure, that is, the concepts and ideas they possess in a given area of knowledge and the way in which it is organized. Meanwhile, these experiences and prior knowledge of learners will affect learning in a beneficial way. In this sense, learning is meaningful when it is possible to teach a subject in a way that is not arbitrary to what the person already knows, but rather, based on what the person knows, a relevant aspect of the cognitive structure is identified and teaching is carried out to achieve this type of learning [Ausubel, 1983].

Meaningful learning occurs when new information can be connected or related to a relevant concept already existing in the learner's knowledge, anchoring prior knowledge to the new information.

This does not mean that knowledge is simply associated, but rather that when interaction between them occurs, new knowledge is generated in the cognitive structure of the individual learner, allowing them to see the difference, growth, and development of knowledge.

To do this, learners must be willing to relate new knowledge not arbitrarily but substantially, identifying that learning is meaningful to them [Ausubel, 1983].

Although meaningful learning has mostly been studied within the university context, where new teaching-learning strategies are created by replacing traditional teaching with constructive learning based on students' existing knowledge to create new knowledge [Huerta-Chávez et al., 2022; Soltero-Sánchez et al., 2023; González-Quezada et al., 2024]. In the public sector, it is important to start with knowledge management, that is, how knowledge is created, shared, and applied, as well as intellectual capital, specifically human capital, which, when formed from the knowledge it possesses, can replicate it in the population subject to social attention, as well as organizational learning [Huerta-Chávez, 2019; Huerta-Chávez & Castro-Valencia, 2019; Huerta-Chávez et al., 2020; Huerta-Chávez, 2021; Huerta-Chávez & Figueroa-Ochoa, 2023].

However, it highlights the importance of meaningful learning in all populations, identifying the problem of food loss and waste due to cultural context, menu planning, and infrastructure, making it extremely necessary to establish strategies to reduce this problem [Carrillo, 2025]. Likewise, the meaningful learning proposed by Ausubel et al. [1976], whose pedagogical approach, as already explained in this section, highlights the importance of connecting knowledge with that previously acquired.

However, it presents obstacles to the traditional teaching-learning process, which is why neuroeducation must now be considered as an alternative for establishing strategies that take into account cognitive diversity and emotional aspects, promoting not only the development of meaningful learning but also the comprehensive development of the learner [Tepale, 2025].

3. Materials and methods

3.1 Research type and design

This research was conducted using a quantitative approach. The data collected was used to test the central hypothesis, according to the numerical measurement performed and the descriptive statistical analysis, in order to establish the behavior of the variables studied and test the theory underlying this research.

It was longitudinal in nature, with data collected at two points in time, at the beginning and end of the training. It was also descriptive and non-experimental, and the study was carried out without intentional manipulation of the variables, as they were only observed in their natural environment [Hernández et al., 2014; and Bernal, 2016].

3.2 Variables

3.2.1 Food guidance and education strategy [FGES]

Training on nutrition guidance and education for public servants responsible for implementing state-level food programs, providing basic knowledge to develop healthy eating habits, so that they in turn contribute to the empowerment of the beneficiaries of these programs in the municipalities to make healthy decisions through proper nutrition and have an impact on reducing food insecurity and other problems that affect the public health of this population. The variables included in this strategy are:

1. TEWP, the healthy eating plate.
2. TDWJ, the healthy drinking jug.
3. HEEA, healthy eating.
4. PHAC, physical activity.
5. AVGE, a vegetable garden for everyone.

3.2.2 Meaningful learning for public servants [MLPS]

Learning achieved by those in charge of state-level food programs based on prior knowledge and training provided on topics related to dietary guidance and nutrition education.

3.3 Measuring instrument

For this research, an instrument was developed with five variables covering the topics taught and five items for each, for a total of 25 questions.

The instrument was validated by expert judgment, and to ensure reliability, Cronbach's alpha index was calculated using the following equation 1:

$$\alpha = \frac{\kappa(1 - \sum_{i=1}^{\kappa} S_i^2 / S_t^2)}{\kappa - 1} \quad [1]$$

Where:

S_i^2 is the variance of the item i

S_t^2 is the variance of all the totals

κ is the number of items

If the items combine additively and measure the unobservable characteristic in the same direction, then the items are strongly correlated and, therefore, the instrument is reliable. In this case, the α coefficient tends to be 1. This corroborated the reliability of the scale, i.e., that it effectively measures the dimensions of service performance, and therefore the results obtained are valid and reliable.

This same instrument was applied as a pre-test and post-test to measure the impact of the food guidance and education strategy on the meaningful learning of public servants responsible for implementing food programs at the state level.

3.4 Participants

Based on a census, 125 public servants from the state of Jalisco in Mexico participated, one from each municipality that has state food programs, achieving 100% representation. Therefore, the calculation of a statistical sample was omitted.

3.5 Procedure

In a state-level public social welfare institution in Mexico, a food guidance and education strategy was implemented through training sessions on food guidance topics.

To this end, those responsible for food programs in the 125 municipalities of Jalisco, initially defined as the target population, were invited to attend the public social welfare institution's facilities in order to learn and replicate the knowledge acquired to the beneficiaries of the food programs, using the food guidance and education material provided, whose main objective was to achieve a change in knowledge and practices in food consumption to improve their nutritional status.

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The method used to collect the information was longitudinal, that is, before the training was given, a pretest with 25 items related to the theoretical content was administered, and after the training, a posttest was administered, which consisted of evaluating the knowledge acquired to identify the impact on learning, specifically in the following topics:

1. TEWP, the healthy eating plate.
2. TDWJ, the healthy drinking jug.
3. HEEA, healthy eating.
4. PHAC, physical activity.
5. AVGE, a vegetable garden for everyone.

3.6 Data analysis

Data analysis was performed using descriptive statistics, tabulation, and graphs to analyze the results obtained from the pre-test and post-test in order to verify the central hypothesis. The data were processed using the statistical program SPSS [Statistical Package for the Social Sciences] version 25 and Microsoft Excel for spreadsheets. Statistical tests were performed to assess the reliability and validity of the instrument using Cronbach's alpha, as well as descriptive statistics and normality tests.

4. Results and discussion

To measure the reliability and internal consistency of the instrument, Cronbach's alpha index was calculated, obtaining an acceptable index above 0.700 [Hair et al., 1999; Nunnally, 1978]. Therefore, these values show that the items in each construct are consistent and measure the same characteristic, making it a reliable instrument [see Table 1].

Box 1

Table 1

Reliability index of the measuring instrument.

Variables	Cronbach's alpha >0.700 [Nunnally, 1978]
TEWP	0.991
TDWJ	0.978
HEEA	0.994
PHAC	0.756
AVGE	0.769

Source: Own elaboration [2025]

Of the public servants trained, 22% were men and 78% were women, bearing in mind that a census was conducted, including 100% of those responsible for implementing food programs in the 125 municipalities of Jalisco [see Figure 1].

Box 2

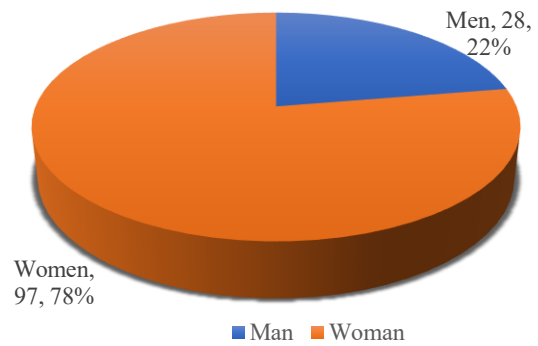


Figure 1

Trained public servants by gender.

Source: Own elaboration [2025]

In terms of age, 43% of trained public servants are under 30 years old, 50% are between 30 and 60 years old, and only 7% are over 60 years old [see Figure 2].

Box 3

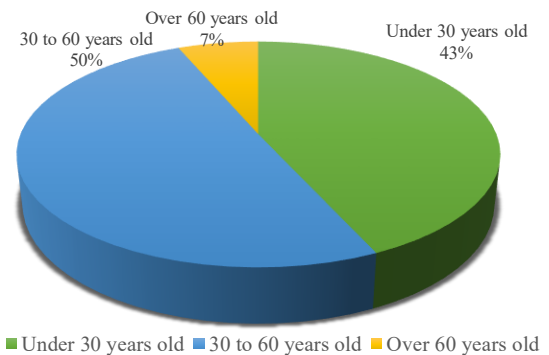


Figure 2

Age of trained public servants.

Source: Own elaboration [2025]

Now, the values obtained for the TEWP variable, the healthy eating plate, on a scale of 0/100, in each of the items that comprise it, both in the pre-test and in the post-test, are as follows: TEWP1, benefits of the healthy plate, 90% and 95% respectively; TEWP2, healthy eating plate groups, 78% and 88% respectively; TEWP3, food groups with reduced consumption, 91% and 97% respectively; TEWP4, main energy source food group, 68% and 74% respectively; and TEMP5, meaning of the color red, 66% and 75% respectively [see Figure 3].

Box 4

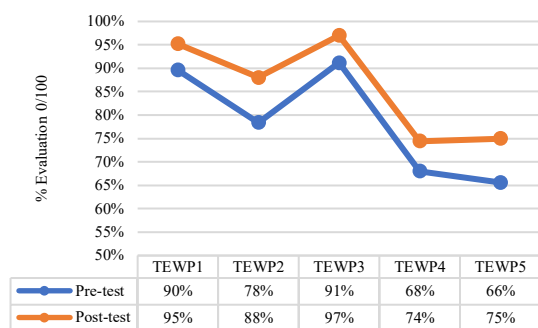


Figure 3

Pre-test and post-test of training on the topic “The healthy eating plate”.

Source: Own elaboration [2025]

In the TDWJ variable, the good drinking jug, the values obtained in both the pre-test and post-test for each of the items are: TDWJ1, illustration of the good drinking jug, 95% and 100% respectively; TDWJ2, proportions of the good drinking jug, 72% and 82% respectively; TDWJ3, levels of the good drinking jug, 88% and 98% respectively; TDWJ4, health problems due to insufficient water consumption, 84% and 90% respectively; TDWJ5, number of glasses of water recommended for drinking, 89% and 98% respectively [see Figure 4].

Box 5

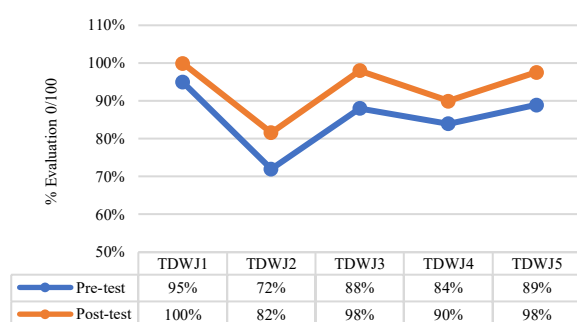


Figure 4

Pre-test and post-test of training on the topic “The jug of good drinking”.

Source: Own elaboration [2025]

The values obtained for the HEEA variable, healthy eating, in both the pre-test and post-test for each item are: HEEA1, factors of healthy eating, 69% and 75% respectively; HEEA2, recommended portions of fruit and vegetables, 71% and 77% respectively; HEEA3, percentage of recommended fat consumption, 59% and 66% respectively; HEEA4, recommended salt intake, 69% and 78% respectively; HEEA5, reduction in sugar intake, 84% and 90% respectively [see Figure 5].

Box 6

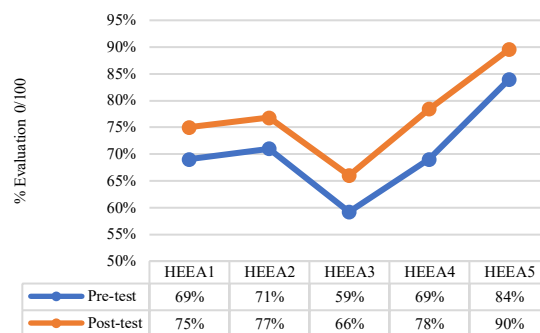


Figure 5

Pre-test and post-test of training on the topic of “Healthy Eating”.

Source: Own elaboration [2025]

With regard to the PHAC variable, physical activity, the values obtained in both the pre-test and post-test for each of the items are: PHAC1, concept of physical activity, 88% and 94% respectively; PHAC2, recommended time for physical activity, 86% and 91% respectively; PHAC3, importance of physical activity, 88% and 100% respectively; PHAC4, sport for people with motor disabilities, 93% and 99% respectively; PHAC5, benefits of physical activity, 89% and 95% respectively [see Figure 6].

Box 7

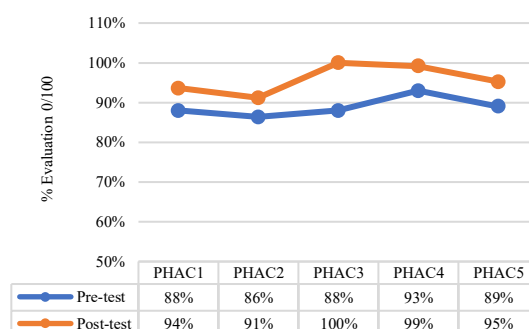


Figure 6

Pre-test and post-test of training on the topic of “Physical activity”.

Source: Own elaboration [2025]

In the AVGE variable, a garden for everyone, the values obtained in the pre-test and post-test for each item are: AVGE1, concept of a garden, 92% and 99% respectively; AVGE2, benefits of having a garden, 93% and 99% respectively; AVGE3, preparing a garden, 92% and 98% respectively; AVGE4, caring for seeds to germinate and plants to bear fruit, 93% and 100%, respectively; AVGE5, ways of planting vegetables, 93% and 99% respectively [see Figure 7].

Box 8

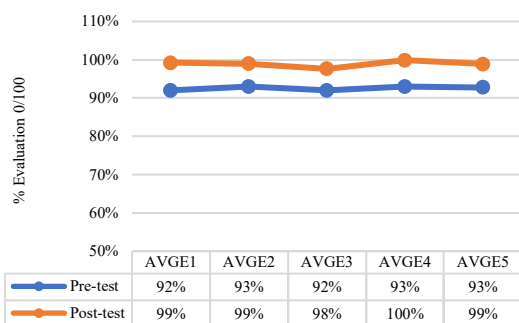


Figure 7

Pre-test and post-test of training on the topic “A vegetable garden for everyone”

Source: Own elaboration [2025]

The measures of central tendency in the pre-test with respect to the minimum values highlighted the HEEA variable for healthy eating, which had the lowest value of 0.59, followed by the TEWP variable for healthy eating with 0.66. In contrast to the maximum values, the TDWJ variable for healthy drinking stood out with a value of 0.95, followed by the PHAC variable for physical activity and the AVGE variable for a garden for all with a value of 0.93. The means obtained range from 0.7040 for the HEEA variable for healthy eating to 0.9260 for the AVGE variable for a garden for all.

However, with regard to the standard deviation measures, the values range from 0.00548 to 0.11781, which confirms that the data are very close to the mean, or expected value.

These data are in decimal form, but they are percentages on a scale of 0/100% [see Table 2].

The measures of central tendency in the post-test with respect to the minimum values highlighted the HEEA variable for healthy eating, which had the lowest value of 0.66, followed by the TEWP variable for healthy eating with 0.74. In contrast to the maximum values, three variables stood out: TDWJ for healthy drinking, PHAC for physical activity, and AVGE for a garden for all, with a value of 1.00. The means obtained range from 0.7220 for the HEEA healthy eating variable to 0.9900 for the AVGE vegetable garden for all variable. However, with regard to the standard deviation measures, the values range from 0.00707 to 0.10849, which confirms that the data are very close to the mean, or expected value.

These data are in decimal form, but they are percentages on a scale of 0/100% [see Table 2].

Box 9

Table 2

Measures of central tendency of the pre-test and post-test for each variable.

	Variable	N	Minimum	Maximum	Mean	Standard deviation
Pre-test	TEWP	125	0.66	0.91	0.7860	0.11781
	TDWJ	125	0.72	0.95	0.8560	0.08562
	HEEA	125	0.59	0.84	0.7040	0.08933
	PHAC	125	0.86	0.93	0.8880	0.02588
	AVGE	125	0.92	0.93	0.9260	0.00548
Post-test	TEWP	125	0.74	0.97	0.8580	0.10849
	TDWJ	125	0.82	1.00	0.9360	0.07537
	HEEA	125	0.66	0.90	0.7720	0.08585
	PHAC	125	0.91	1.00	0.9580	0.03701
	AVGE	125	0.98	1.00	0.9900	0.00707

Source: Own elaboration [2025]

The learning assessed in the pre-test and post-test allows us to verify the central hypothesis, rejecting the null hypothesis and accepting the alternative, where the implementation of the food education and guidance strategy [FGES] by the state social assistance institution has an impact on the meaningful learning of the trained public servants [SLSP], since in the 25 items used to evaluate the five variables, it is possible to find that in all of them, significant learning was detected, ranging from 5% to 12%, detecting a difference between the initial and final learning achieved [see Figure 8].

Box 10

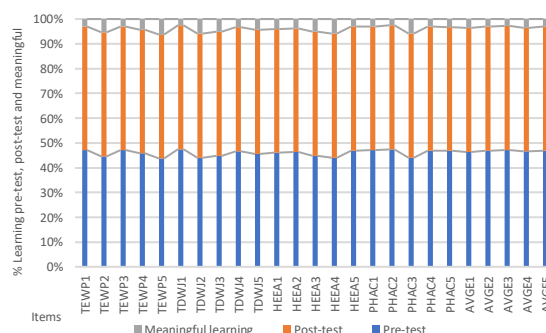


Figure 8

Meaningful learning achieved

Source: Own elaboration [2025]

The results obtained in the pre-test, post-test, and meaningful learning for each item are:

TEWP1	90%	95%	6%
TEWP2	78%	88%	10%
TEWP3	91%	97%	6%
TEWP4	68%	74%	6%
TEWP5	66%	75%	9%
TDWJ1	95%	100%	5%
TDWJ2	72%	82%	10%
TDWJ3	88%	98%	10%
TDWJ4	84%	90%	6%
TDWJ5	89%	98%	9%
HEEA1	69%	75%	6%
HEEA2	71%	77%	6%
HEEA3	59%	66%	7%
HEEA4	69%	78%	9%
HEEA5	84%	90%	6%
PHAC1	88%	94%	6%
PHAC2	86%	91%	5%
PHAC3	88%	100%	12%
PHAC4	93%	99%	6%
PHAC5	89%	95%	6%
AVGE1	92%	99%	7%
AVGE2	93%	99%	6%
AVGE3	92%	98%	6%
AVGE4	93%	100%	7%
AVGE5	93%	99%	6%

These results corroborate the theory described in Mexico's food scenario, which mentions that there have always been food programs and policies aimed at improving the nutrition of vulnerable populations, including education, health, food, and development.

However, this has not yet been achieved, because strategies are needed to promote access to the basic food basket, redesign food production policies and strategies, promote physical activity, and encourage good eating habits.

In fact, Article 4 of the Mexican Constitution highlights the population's right to nutritious, sufficient, and quality food, for which the State itself is responsible, contributing to SDG 2, which refers to ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture [Acosta, 2017; Barquera et al., 2001; Bertran, 2010; Castañeda-Sánchez, et al., 2008; Soria & Palacio, 2014; Urquía-Fernández, 2014].

In this regard, evaluations of food programs and social policies that promote changes in eating habits and food distribution should continue to be generated. Food aid programs should also be better targeted [Aguirre et al., 2017; Huesca et al., 2016; Morales-Ruán et al., 2013; Salazar, 2016]. In addition, income should be provided to prevent food deprivation [Shamah-Levy et al., 2021] and the shift away from diets based on beans and corn [Sandoval et al., 2025] and the poverty and physical-geographical conditions that limit access to food [Ortega-Marín & González-Rosas, 2023; & Ríos-Llamas & Tapia-Galindo, 2024].

Even though public food policy was focused on food availability and access [Arellano-Esparza, 2022], the enactment of the General Law on Adequate and Sustainable Food [GLASF] now contemplates both equitable distribution and food education [Ortega-Ibarra et al., 2025] to improve the quality of life of the population.

Studies conducted at various universities and in the evaluation of food programs continue to identify two main trends: some claim that having the knowledge to improve eating habits will not directly influence a change in attitude toward choosing healthy diets [Montero, et al., 2006; Niembro & Sosa, 2013] while other studies show that knowledge of healthy habits can lead to healthy eating plans and prevent health problems [Bonilla & Caballero, 2025; Castañeda-Sánchez et al., 2008; Cervera et al., 2013; Fierro et al., 2019; González-Hinojosa et al., 2022; Horna et al., 2018; Lapo et al., 2019; Leal, 2025; Ramos, 2025; Salazar, 2016; Tepale, 2025; Torres-Mallma, et al., 2016; Trescastro et al., 2012; Villalba & Dávalos, 2013; Velázquez et al., 2021].

In addition to these findings, it should be noted that currently 59.1% of families in Mexico lack sufficient economic resources to obtain adequate nutrition in terms of quality and quantity. This leads to significant human, social, and economic costs for Mexico, as it is highly correlated with productivity, high rates of poverty and marginalization, wasted human potential, and social exclusion, especially in the country's indigenous and rural communities [Ayala, 2024]. Therefore, education and awareness campaigns are needed to improve the population's eating habits and address public health problems such as overweight, obesity, and malnutrition [Acosta, 2017].

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This confirms the urgent need to continue with food education and guidance strategies, as was done in this research.

The results obtained showed percentages greater than 5% in meaningful learning, which corroborates Ausubel's theory, whereby considering the knowledge that the learner already has allows them to generate new knowledge from the interrelation of concepts or knowledge they already possessed, producing the anchoring of ideas and relevant aspects [Ausubel et al., 1976; Ausubel, 1983; Ausubel, 2000; Carrillo, 2025; Guamán & Venet, 2019; Ordóñez & Mohedano, 2019].

Finally, meaningful learning is relevant for the public sector, mainly in educational institutions [Huerta-Chávez et al., 2022; Soltero-Sánchez et al., 2023; González-Quezada et al., 2024] and in other government agencies based on knowledge management, intellectual capital, and organizational learning that impacts what is learned and can be replicated with the population to whom public programs are dedicated [Huerta-Chávez, 2019; Huerta-Chávez & Castro-Valencia, 2019; Huerta-Chávez et al., 2020; Huerta-Chávez, 2021; Huerta-Chávez & Figueroa-Ochoa, 2023].

5. Conclusions and recommendations

Following the detailed analysis carried out in the presentation of results, it is concluded that the variables evaluated as part of the food guidance and education strategy have contributed to the development of healthy eating habits among the beneficiary population, as well as improving the nutritional status of that population.

Thus, the basic knowledge provided in the various topics of food guidance and education has contributed to the empowerment of beneficiaries by encouraging healthy decision-making with proper nutrition. This reflects the verification of the central hypothesis.

The above is confirmed in each of the responses obtained in the pre-tests and post-tests administered to the 125 public servants responsible for operating food programs and various food strategies in the municipalities of the state of Jalisco.

The results obtained show higher percentages of correct answers in the post-test, which allows us to see the impact on the meaningful learning achieved. In general, the implementation of the food guidance and education strategy has had a considerable impact on the knowledge of the beneficiaries of food programs and their strategies, which allows the state public social assistance institution to make decisions to strengthen and maintain these actions.

The main limitations faced by this research were the exclusive use of descriptive statistics. Therefore, we suggest the use of structural equation modeling and the inclusion of new variables that influence the improvement of eating habits in the population.

6. Annexes

The variables and items of the instrument used in the pre-test and post-test are shown below:

1. Illustration of the good drinking jar
2. Proportions of the good drinking jar
3. Levels of the good drinking jar
4. Health problems caused by insufficient water intake
5. Recommended number of glasses of water to drink

Variable	Item
TEWP	1. Benefits of the healthy eating plate
	2. Groups of the healthy eating plate
	3. Food groups to consume in moderation
	4. Main food group as a source of energy
	5. Meaning of the color red
TEWJ	1. Illustration of the good drinking jar
	2. Proportions of the good drinking jar
	3. Levels of the good drinking jar
	4. Health problems caused by insufficient water intake
	5. Recommended number of glasses of water to drink
HEEA	1. Factors for healthy eating
	2. Recommended fruit and vegetable portions
	3. Recommended fat consumption percentage

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- PHAC
4. Recommended salt consumption
 5. Reducing sugar intake
1. Physical activity
 2. Recommended amount of physical activity
 3. Importance of physical activity
 4. Sports that people with motor disabilities can do
 5. Benefits of physical activity
- AVGE
1. Definition of a vegetable garden
 2. Benefits of having a vegetable garden
 3. Preparing a vegetable garden
 4. Caring for seeds to germinate and plants to bear fruit
 5. Ways to plant vegetables

7. Declarations

7.1 Conflict of interest

The authors declare that they have no conflict of interest. They have no financial interests or personal relationships that could influence the results reported in this research paper.

7.2 Authors' contributions

Huerta-Chávez, Irma Alicia: Materials and methods, review of the state of the art, results and discussion; and contribution to the writing of the article.

Soltero-Sánchez, Jazmín del Rocío: Introduction, review of the state of the art, references, and contribution to the writing of the article.

González-Quezada, Esperanza: Conclusions and recommendations, appendices, declarations, abbreviations, and contribution to the writing of the article.

Figueroa-Ochoa, Edgar Benjamín 4th author: Abstract, materials and methods, results and discussion; and contribution to the writing of the article.

7.3 Availability of data and materials

The databases and statistical analyses are available upon request by email to the corresponding author of this article.

7.4 Funding

The authors did not receive financial support for the design, planning, and execution of the research, nor for the publication of this article. Therefore, the financial, material, and human resources were absorbed by the authors of this scientific article.

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8. Abbreviations

AVGE	A vegetable garden for everyone
FNEP	Food and Nutrition Education Program
FAO	Food and Agriculture Organization of the United Nations
FGES	Food guidance and education strategy
HEEA	Healthy eating
GLASF	General Law on Adequate and Sustainable Food
SDG	Sustainable Development Goal
FAP	Food Aid Programs
PHAC	Physical activity
MLSP	Meaningful learning of trained public servants
SPSS	Statistical Package for the Social Sciences
TEWP	The plate of good eating
TDWJ	The jug of good drinking
NAFTA	North American Free Trade Agreement

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9.5 Discussions

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