Perception of the Certifying Courses in a Competency-based Curriculum of an Undergraduate Degree in Nutrition

Percepção Sobre as Disciplinas Certificadoras de uma Matriz por Competências de um Curso de Nutrição
Percepción Sobre las Asignaturas Certificadoras de una Malla Curricular Basada en Competencias de una Carrera de Nutrición

RESUMO
Objetivo: Avaliar a percepção de docentes e discentes sobre o papel das disciplinas na certificação das competências da matriz curricular de 2019. **Método:** Estudo qualitativo que envolveu a elaboração prévia de mapas mentais das disciplinas certificadoras de uma matriz por competências de um curso de graduação em Nutrição, utilizados como referência para a aplicação de um questionário estruturado a discentes do sexto semestre e a docentes de todas as disciplinas. Os dados foram analisados por análise de conteúdo. **Resultados:** Participaram da pesquisa 15 docentes e 28 discentes. Em relação à percepção dos discentes, emergiram quatro categorias: sequência lógica das disciplinas; segurança/insegurança na base para o desenvolvimento das disciplinas certificadoras; estágio como treinamento da prática profissional; e, valorização do cuidado. Para docentes, evidenciou-se a percepção da conexão entre a disciplina e o mapa mental que representa a competência e seu papel na matriz e atividades de ensino que relacionam temas de estudo com a competência. **Conclusão:** A análise possibilitou a identificação de ajustes curriculares necessários antes da conclusão do curso, contribuindo para o aprimoramento contínuo da educação baseada em competências.
DESCRITORES: Ciência da Nutrição; Professores; Educação baseada em competência; Estudantes.

ABSTRACT
Objective: To evaluate the perception of faculty and students regarding the role of courses in certifying the competencies of the 2019 curriculum framework. **Methods:** Qualitative study involving the prior development of mental maps of the certifying courses within a competency-based undergraduate Nutrition curriculum, used as a reference for the application of a structured questionnaire to sixth-semester students and faculty from all courses. Data were analyzed using content analysis. **Results:** The study included 15 faculty members and 28 students. From the students' perspective, four categories emerged: logical sequence of courses; confidence or insecurity regarding the foundational knowledge for the development of certifying courses; internships as professional practice training; and valuing care. For faculty, results highlighted the perceived connection between their courses and the mental map representing the competency, as well as the role of the course within the curriculum and teaching activities linking study. **Conclusion:** The analysis made it possible to identify necessary curricular adjustments prior to course completion, contributing to the continuous improvement of competency-based education.
DESCRIPTORS: Nutrition Science; Teachers; Competence-based education; Students.

RESUMEN
Objetivo: Evaluar la percepción de docentes y estudiantes sobre el papel de las asignaturas en la certificación de las competencias del marco curricular de 2019. **Método:** Estudio cualitativo que implicó la elaboración previa de mapas mentales de las asignaturas certificadoras de una carrera de Nutrición basada en competencias, utilizados como referencia para la aplicación de un cuestionario estructurado a estudiantes del sexto semestre y a docentes de todas las asignaturas. Los datos fueron analizados mediante análisis de contenido. **Resultados:** Participaron en el estudio 15 docentes y 28 estudiantes. Desde la perspectiva de los estudiantes, surgieron cuatro categorías: secuencia lógica de las asignaturas; confianza o inseguridad respecto a los conocimientos fundamentales para el desarrollo de las asignaturas certificadoras; prácticas profesionales como entrenamiento práctico; y valoración del cuidado. Para los docentes, los resultados destacaron la co-

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nexión percibida entre sus asignaturas y el mapa mental que representa la competencia, así como el papel de la asignatura dentro de la carrera y las actividades de enseñanza que vinculan los temas de estudio con las competencias. **Conclusión:** El análisis permitió identificar ajustes curriculares necesarios antes de la finalización de la carrera, contribuyendo a la mejora continua de la educación basada en competencias.
DESCRIPTORES: Ciencias de la nutrición; Docentes; Educación basada en competências; Estudiantes.

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INTRODUCTION

The construction of a Competency-Based Curriculum Matrix involves a series of steps that must be carefully followed. Therefore, constant evaluation during the process is essential to indicate paths to be followed in order to make improvements.

The NN (NN) Nutrition Undergraduate Course underwent a reformulation in 2019, with the implementation of a competency-based curriculum. The development began with the definition of the competencies required of professionals, based on the National Curriculum Guidelines. Furthermore, these competencies were constructed based on research conducted with graduates of the program and with relevant professionals in the market.

This process involved the active participation of the Course Pedagogical Design Group (Núcleo Docente Estruturante , NDE), consisting of a group of teachers with academic responsibilities for the design, consolidation, and continuous updating of the Course Pedagogical Project. To promote understanding and engagement of faculty members in the new Pedagogical Project for the Nutrition Course, the NDE and the course coordinators held meetings in which the theoretical foundations for the construction of the Matrix were presented, establishing the steps for its implementation.

Three years after the implementation of the new Matrix, the NDE conducted this study with the objective of evaluating the perception of teachers and students on the role of the subjects taught and studied, respectively, in the certification of each of the competencies of the new Matrix. This text presents the data collected, the treatment of the results, the analysis of the categories evidenced, and the conclusions obtained.

METHOD

The study was conducted before the start of the semester of the certifying subjects with a convenience sample consisting of 15 teachers and 28 students completing the sixth period of the Undergraduate Nutrition Course at NN. To safeguard ethical aspects in accordance with Resolution No. 466/2012 of the National Health Council[1], this study was submitted to and approved by the NN Human Research Ethics Committee, under

Opinion No. 84195424.0.0000.0020. After approval, the target audience was invited to participate and, once accepted, the participants were informed and clarified about the research and the relevant confidentiality and signed a Free and Informed Consent Form.

This is a case study using a qualitative analysis method. Bruyne, Herman, and Schoutheete (1977)[2]define a case study as an intensive analysis carried out in one or more real organizations. For them, this type of technique collects as much information as possible and in as much detail as possible to understand the entirety of the situation being studied. Case studies are probably the most widely used modality among qualitative research approaches. Such studies can also be conducted based on different paradigms and theoretical frameworks[3].

Initially, teachers responsible for the certifying disciplines of the three major areas of Nutrition (Clinical Nutrition, Public Health, and Food in Communities) were asked to develop Mind Maps that clearly and comprehensively represented all the elements of competence that make up the competency. The mind map was developed following the guidelines of Saroyan and Amundsen, as they emphasize that the main purpose is to reveal thinking about general concepts, the nature of the relationships between concepts, and the discipline as a whole. Its effectiveness is proven when the course participant can effectively see all of its key elements in this map.

To stimulate reflection among teaching participants and facilitate the identification of key elements of the mind map, a *template* prepared by the NDE was sent out. This *template* included spaces for integrating the syllabus, learning outcomes of the certifying discipline, and a request for details on how students would demonstrate their knowledge of how to act for each competency element, i.e., authentic learning situations.

The mind maps for the courses were then presented at an NDE meeting for discussion and refinement. After approval of the final versions of the mind maps for the competencies related to the three major areas of Nutrition, an electronic questionnaire consisting of three questions was sent to all teaching participants in the course. It should be noted that the three mind maps were sent in the same file that also contained the three questions listed below:

> Question 1) With a view to certifying the competency "_____" (space where the competency text was inserted), the mind map shown below was developed. Are there connections between this mind map and the subject(s) you teach?
> Question 2) If you see any connection between the subject(s) taught and the mind map above, answer: What is the role of this/these subject(s) in ensuring that students are prepared for certification?
> Question 3) What activities were planned in the subject(s) taught that are directly or indirectly related to the mind map you see?

Next, an electronic questionnaire was sent to the student participants who had completed the sixth period of the course with the questions and the mind map:

> With a view to certifying the competency "_____" (space where the competency text was inserted), the mind map shown below was created. Based on this mind map, answer the following questions:
> Question 1) What role did each subject you have already taken play in the completion of this mind map?
> Question 2) Based on the same mind map as in the previous question: what do you still need to learn in order to perform excellently in this subject?

The mind maps were sent by teaching participants from the major areas and separately. Fragments of answers were identified by alphanumeric codes according to the sequence of answers, with the initial "P" for teaching participants and "E" for student participants.

Data analysis was conducted using a content analysis approach, according to Bardin[5], which allows for in-depth interpretation of the context, articulating the signifiers and meanings of the statements, considering psychosocial variables, cultural context, and the message production process.

Within this approach, Thematic Analysis was used as an operational technique to organize and systematize the data. This process involved three main stages: data coding, identifying relevant segments of the text; development of descriptive themes, with each coded segment representing a specific aspect; and construction of analytical themes, in which interpretive constructs, explanations, and hypotheses were generated from the interpretation of the data.

The final categories were determined inductively, based on participants' responses, and interpreted in light of the theoretical framework adopted. This integration allowed for a detailed and contextualized analysis, articulating systematic organization (thematic) and semantic interpretation (content).

RESULTS

A total of 15 teaching participants who taught the course subjects and 28 student participants took part in the research. The results were analyzed by teachers of the certifying subjects.

The categories of analysis extract-

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ed from the responses of teaching participants were: 1) The perceived connection between the subject and the mind map representing the competency and its role in the curriculum matrix, and 2) Teaching activities programmed in the subject that relate the subject's study topics to the competency.

Some teaching participants clearly perceived the connection between different areas based on the mind map, perceiving Nutrition as a whole composed of several parts, without fragmentation:

> *There is a connection between the subjects in the clinical area and the mind map of the internship subject at UAN [Food and Nutrition Units] in the following aspects: people management, hospital nutrition service management, including menu planning for hospitalized patients, purchasing policy, and standardization of enteral diets. Also in relation to the vision of developing products targeted at pathologies as a business and marketing products for enteral nutrition* (P4 [Clinical Nutrition area]).

> *Subjects in the area of public health contribute to the development of an integrated vision of the role of the organization of people and services related to food production and its articulation with public health scenarios, as in the case of Food and Nutrition Programs. They also contribute to the development of scientific reasoning regarding food/meal production that considers the Human Right to Adequate Food (DHAA), culturally referenced food, and the impacts of food production on the nutritional status of individuals and populations, as well as an understanding of the nutritional epidemiological transition* (P19 [Public Health area]).

It was found that even teaching participants in the initial phase of the course, with backgrounds in Biology, Dentistry, Pharmacy, Psychology, and Chemical Engineering, were able to identify roles for their discipline when viewing the mind map. For example, the reports of one participant applied to various areas of Nutrition:

> *knowledge of psychological aspects that can interfere with health actions is fundamental to understanding the patient holistically and promoting autonomy (P21), referring to Public Health.*

> *knowledge of psychological aspects that can interfere with this diagnosis and nutritional guidelines is fundamental to understanding the patient holistically " (P21), for the area of Clinical Nutrition;*
> *developing skills for relationships with other professionals is important for this work (P21), connecting the discipline to work in Food for Communities.*

Only in one situation was there a lack of perception of connection with one of the areas. In this sense, the research was important for the NDE to visualize the need for adjustments through contact with the aforementioned teacher.

For the second category of analysis, a diversity of approaches adopted by teaching participants was observed when viewing the mind maps of the certifying discipline for each of the major areas of Nutrition. When referring to subjects in the area of Clinical Nutrition, on the one hand, there was a prioritization of the use of clinical case studies, although less frequently, conceptual and mind maps, guided study, seminars, and simulations were also mentioned. On the other hand, teaching participants in the area of Food for Communities opted for strategies such as menu planning and the development of educational materials.

Business games, which are *cases* presented to student participants, demonstrated the use of digital learning technologies. In the field of Public Health, the development of educational materials and protocols for action emerged frequently, followed by seminars and case studies. It is noteworthy that case studies appear as a constant in all areas.

In analyzing the responses of student participants, four categories were observed: logical sequence of subjects in the curriculum; confidence in basic knowledge for the development of certifying subjects; internships as training for professional practice; and, finally, valuing care for others.

For the first category, after taking numerous subjects over three years, student participants perceive the connections between subjects within a logic of increasing complexity. As can be seen in the response sent:

> *Each subject played an important role in our academic training. In the 1st and 2nd semesters, we studied basic subjects to understand our body, such as biochemistry, nutrition experiences, anatomy, etc. From the second year of college, we entered the world of nutrition and learned a little about food, were introduced to UAN, learned about key diseases in gastroenterology, saw how each stage of life influences and affects our bodies, as well as more complex diseases in chronic diseases and how clinical practice works* (E10).

Other student participants , perceive the relationship of continuity

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and construction between preceding and subsequent disciplines. It should be noted that in this curriculum, there was no delimitation of the concept of prerequisites. Only the internship discipline had a position requirement, determined when there is a need to complete a total number of credits so that students can take the internships. For example, E29 states that "the role of these subjects is precisely to provide a basis for supporting the practical work, to provide support, in addition to ethics, and to show collaboration with other subjects." Or, further, the statement:

> *All the subjects taken have the function of helping us to achieve the activities programmed in the mental map. In addition, the subjects already taken within this context are interrelated, that is, one is like a prerequisite for the realization and understanding of the other, where through classes and activities we learn a lot so that we can carry out the activities programmed in the mental map effectively* (E26).

For the second category of analysis, insecurity was reported in relation to subjects involving the application of techniques, correlated with the context of the coronavirus disease-19 (COVID-19) pandemic. Student participants went through the pandemic phase with synchronous classes, using virtual learning environments and *Hiflex* technology—classes are taught in classrooms with a limited number of students in person and a portion remotely—when they were in their third, fourth, fifth, and sixth semesters. Practical classes were held at the end of the pandemic in a concentrated manner, in subgroups, rather than throughout the semester. According to the report:

> *due to the pandemic, we had fewer practical classes, such as anthropometry practices. There should be more supervised classes, because even though I am training at home, I am not confident about my practice during the internship* (E10).

Even within this context, some participating students expressed confidence in the fundamentals for completing the certifying courses, highlighting the differentiation of the University's curriculum. Thus, they detail the reports:

> *I believe that the study topics are excellent and play a very important role in the professional development of academics. In my opinion, the theoretical foundation offered by PUC has no major flaws; all fundamental topics are explored in depth and explained clearly. From that point on, it is only necessary to know how to relate all the topics to actual practice, but we need to understand that all the study topics covered are directly related to the practice that lies ahead, as we must have knowledge ranging from food to understanding each patient's beliefs, social condition, and many other factors that interfere in the relationship between patients and food* (E13).

> *In my opinion, in all sincerity, I believe that the foundation that Nutrition students at PUC-PR have in this context is unique. Although I do not have much affinity with the area [referring to the area of food and nutrition unit management], I know that it is one of the main and most important areas of the nutritionist profession, and with all the learning and classes I have had, I can say that I was positively surprised by the complexity of the functions and what lies behind the area. In my opinion, none of the subjects left anything to be desired for me to perform excellently in the certifying discipline. I believe that what is missing now is to put all the learning into practice in the supervised internship in food services and always be willing to learn and acquire new knowledge* (E26).

As for the third category of analysis, some student participants recognize the internship as a time for practical application of theory, as a form of professional experience. The reports corroborate this:

> *What remains to be learned at this point is the practical side of all Nutrition. The theory, the basis of knowledge, and the path we must follow have already been laid out for us; now all that remains is the practical part, to put all our knowledge into action* (E5).

> *The theoretical part was very well presented by the disciplines. What is missing is the practical part, which only the internship can provide. The internship allows us to expand our view of the disciplines, enabling us to experience firsthand the difficulties and pleasures of the profession* (E8).

It is interesting to note in the responses the concern for caring for others, which is a motivation for taking the course. The report states:

> *I believe that the most complex part is adapting the actions that must be taken to the patient's routine and guiding the patient on how to act* (E19).

Also, in the same vein:

> *Now I need to put into practice the lessons I have learned over*

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> *the last three years. We are apprehensive, but this motivates us to do our best, for ourselves and for the patient who hopes to improve their quality of life* (E16).

And also, the report:

> *... I often forget the necessary and mandatory procedures and act just like a normal person, but I often need specific nutritional assistance and still need to consult my little book for help. And I believe that I should look at the individual more as a whole and not as a specific case, and understand that we can be flexible in our decision-making as long as it does not harm the patient.* (E14).

This demonstration of responsibility for care emerges as indicative of the knowledge cultivated throughout the course as an essential component of all competencies.

DISCUSSION

Competency-based training is a relatively new teaching-learning model in higher education[6]. The assumptions of this Competency-Based Curriculum meet contemporary pedagogical needs in training, especially when it comes to future health professionals.

In this research, the NDE provided guidance to teachers in developing mind maps for the certifying disciplines. Conceptually, these maps are visual representations that highlight key points of information and connect to the functions of the mind: relating, classifying, and systematizing. The mind mapping methodology is also a teaching technique, as it is a visual representation of information, regardless of prior knowledge of the subject[7]. Thus, in guiding the design of mind maps, a *template* was developed so that learning outcomes would be the starting point for how students would demonstrate their knowledge of the competency for certification

In the Competency-Based Curriculum, the focus is on what students are expected to learn/understand, rather than what must be taught. Thus, first, the outcomes are defined, then the processes necessary to achieve them[8].

The defined learning outcomes describe what students are expected to know, understand, and/or be able to do after completing a course or obtaining a passing grade in a course[9].

The reports of the participating teachers summarize the perception that there is a connection between the areas and that the subjects, specifically, support the development of competencies. To this end, it is necessary to verify learning in an appropriate manner, considering aspects that encompass the diversity of possibilities within the same competency. Nicola and Amante[10] argue that competency-based matrices require new learning assessment practices, proposing effective tools that assess students' performance, production, and procedures in a given competency.

It is interesting to note the differences in teaching strategies applied by course instructors, which reflect specific pedagogy to meet the demands and peculiarities of each area. A competency-based curriculum in higher education aims to respond to the needs of professional life. To this end, it requires the development of different and innovative teaching practices[9].

The case study, which involves problem-based learning, was a methodology reported for learning in all areas. It presents students with a narrative accompanied by questions and activities that promote group discussion and complex problem solving, facilitating the development of the highest levels of Bloom's cognitive learning taxonomy, as it begins with the recall of knowledge but moves on to analysis, evaluation, and application[11]. Comparisons were also made between problem-based learning and case-based learning, the latter being differentiated by being oriented towards specific objectives determined in the question script[12].

In this research, the reports of the student participants show that, despite not yet having had contact with the certifying discipline, they were able to visualize correlations between previous disciplines and the certifying discipline through their mind map. In addition, they alerted the NDE to the need to provide guidance to final-year teachers about their fears and the need to carry out practical review activities before the start of the final internships.

Some studies have focused on the evaluation of competency matrices after their implementation. For example, Pícoli et al.[13]conducted a survey of graduates' perceptions regarding the acquisition of competencies outlined in the pedagogical project of the Medicine Course. The authors conclude that there was recognition of the acquisition of competencies, skills, and knowledge in an integrated manner, favored by the Problem-Based Learning pedagogical method.

Prendi et al.[14] and Seeleman et al.[15] demonstrate quantitative assessments of the effectiveness of the competency-based matrix carried out after graduation. Specific questionnaires for each field of training were used as tools to detect problems in subareas, quantitatively indicating the need for curricular improvement. In contrast, Guzmann et al.[16] used a qualitative method as a model for evaluating the competency-based curriculum, with teachers as key informants and focus groups of six to ten students in their third and fourth years of a health course. To apply this methodology, both the interviews and the focus groups followed semi-structured

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guides designed to focus on institutional aspects, training, and the learning environment. These results pointed to necessary improvements in the process.

In another study, Matia et al.[17] aimed to develop an instrument to support teachers in assessing the general competencies of students in health courses, test the reliability of the instrument with teachers and students in the same field, and validate the general competency instrument aimed at teachers and students in the health field. Raymundo et al.[18]investigated the effectiveness of implementing the integrated curriculum in the Physical Therapy Course, with faculty members participating in the research. As a result, there was a perception of greater flexibility in the Competency-Based Curriculum, allowing for changes according to needs.

It can therefore be observed that the evaluation of competency matrices can be carried out both during and after the completion of training. In the study presented here, the objective was to carry out the evaluation during the course of training, detecting weaknesses and necessary reinforcements, according to the demands raised by teachers and students.

Another aspect to be highlighted is the methodology used. The starting point for the evaluation was the development of mind maps of the certifying disciplines, which enabled the inclusion of faculty from the initial to the final periods of the course as participants in the research. Faculty are "key actors" in the implementation of the planned curriculum. In this sense, the method applied provides a comprehensive view of the importance of each stage of training in achieving the competencies expected of nutrition professionals.

The reports of student participants on the development of competence are highlighted as challenges in practice. It is observed that they: consider it important to acquire skills in subjects that are added throughout the course, understand strengths and weaknesses, recognize the importance of practice for acquiring competence, and emphasize the value of caring for others as knowledge inherent to the professional.

> "In addition, there is a clear need to develop competencies that form a broader professional profile, one that goes beyond technical and scientific knowledge."

A competent professional committed to social demands develops over a longer process, in which personal characteristics are articulated with the specificities of professional practice. It is therefore necessary to map the articulation of theories, methods, and experiences in solving everyday social and professional problems[19].

This is the first study to address the perception of teachers and students on the role of different disciplines in the Nutrition Course for the certification of competencies, using a differentiated methodology that is easy to replicate in other courses. One cannot fail to consider the limitations due to the numerous adaptations required of students, teachers, and the University during the COVID-19 pandemic.

CONCLUSION

Based on the reports, it can be said that teachers perceive, in the mental map of certifying subjects, the participation of the subject they teach in the process of building competence. Students, in a concrete way, visualize their potential as professionals and understand the importance of the parts in forming the whole, which is the completeness of agents of the profession. This demonstrates that the construction of the competency matrix was consistent and with a progressive increase in the complexity of learning, culminating in confidence in the completion of the certifying discipline.

The methodology used in this study allowed for the evaluation of the competency-based curriculum matrix before the end of the course, enabling the detection of necessary adjustments before the students graduated. The role of the NDE in this process is noteworthy, as it guided the development of the mind maps that formed the basis for the construction of the course performance indicators.

Another important aspect is the continuity of the process in sequential semesters, so that the methodology becomes a support for the self-assessment of the achievement of competencies by students and the procedural assessment of the need for adaptations or changes in the courses in the perception of teachers.

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