

Needs Assessment for Developing Literacy-Based Teaching Materials with Quantum Teaching in Food and Nutrition Data Analysis

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Abstract. This study assesses students' needs for developing literacy-based teaching materials using the Quantum Teaching approach in food and nutrition data analysis courses. Data were collected via a Likert-scale questionnaire (1–5) with 15 closed-ended and 2 open-ended questions, analyzed descriptively across five thematic areas. The overall mean score was 3.81. Specifically, Section A: Knowledge scored 3.8 (Agree); Section B: Skills and Tools 3.5 (Agree); Section C: Learning Methods 4.3 (Agree); Section D: Learning Challenges 3.4 (Neutral); and Section E: Expectations for Quantum Teaching 4.1 (Agree). Students identified the need for more interactive, practical, and engaging materials. Challenges included the theory–practice gap and limited study time. There was a strong desire for integrating Quantum Teaching to boost motivation and learning effectiveness. These results form a vital basis for designing innovative, student-centered materials that promote literacy, practical skills, and engagement in nutrition data analysis.

Keywords: Literacy, nutrition education, needs analysis, teaching materials, quantum teaching,

1 Introduction

Teaching and learning activities represent an interaction between lecturers and students, in which the achievement of instructional objectives determines the success of the process [1], [2]. In the field of nutrition education, one critical area is food and nutrition data analysis. This discipline provides students with the ability to process and interpret dietary data, which later becomes the foundation for developing programs and policies in both short- and long-term contexts [3]. Strengthening students' analytical competence is therefore a priority in nutrition

study programs, as it equips them with essential skills for addressing public nutrition challenges [4].

Despite its importance, conventional teaching methods often fall short in effectively building students' analytical capabilities. Previous studies highlighted that nutrition education programs tend to emphasize theoretical knowledge, while practical skills in data analysis remain underdeveloped [5]. At Universitas Negeri Medan, for example, most students conduct community-based research for their final projects and work with large-scale datasets. However, many face difficulties due to the lack of comprehensive learning materials that can be accessed flexibly to support independent study and practice.

Quantum Teaching emerges as an innovative pedagogical model that emphasizes interactive, experiential, and student-centered learning. By integrating communication, engagement, and real-world context, this approach is designed to enhance both motivation and understanding [6], [7]. Its principles align with the needs of nutrition students, as it makes abstract and technical content—such as data analysis—more accessible and engaging. When applied to nutrition education, Quantum Teaching has the potential to improve both the learning atmosphere and student comprehension.

In addition, literacy-based learning materials are crucial for ensuring that students can grasp complex concepts and apply them in practical contexts. Prior research demonstrated that integrating literacy elements—such as numerical, linguistic, and socio-psychological aspects—into teaching materials fosters greater interest and understanding [8], [9]. Therefore, the development of literacy-oriented teaching materials that incorporate the Quantum Teaching model represents a promising solution to optimize learning effectiveness. This study aims to analyze the learning needs of nutrition students as a foundation for developing such teaching materials, specifically targeted at strengthening competencies in food and nutrition data analysis.

2 Method

This research was conducted at the Nutrition Study Program, Universitas Negeri Medan, and employed a research and development (R&D) approach adapted from the 4D model (Define, Design, Develop, Disseminate). However, the present study was limited to the Define stage, which focused on identifying learning needs as the foundation for developing literacy-based teaching materials characterized by the Quantum Teaching approach.

At this stage, two main activities were carried out. First, a review of the Rencana Pembelajaran Semester (RPS, or Semester Learning Plan) for the Food and Nutrition Data Analysis (FNDA) course was conducted. This review was carried out collaboratively by the researchers and the course teaching team through a focus group discussion (FGD). The discussion explored learning objectives, course content, and competencies required by students to ensure that the teaching material to be developed would align with curriculum standards.

Second, a needs assessment was conducted with undergraduate nutrition students. The assessment took place in June and involved 43 students who were asked to complete a structured questionnaire. The instrument consisted of five sections: (A) Basic Knowledge and Understanding of the Subject; (B) Skills and Proficiency in Using Analytical Tools; (C)

Learning Methods and Needs for Teaching Materials; (D) Challenges and Barriers in Learning; and (E) Expectations for Literacy-Based Teaching Materials Using the Quantum Teaching Approach. Responses were measured using a five-point Likert scale, ranging from strongly disagree (scale 1) to strongly agree (scale 5).

Data obtained from the questionnaire were analyzed using descriptive statistics to identify key themes and student learning needs. The results of this analysis serve as the basis for determining the chapters and subchapters to be included in the teaching materials.

3 Results and Discussion

In the first stage, two activities were carried out as the foundation for the subsequent design phase. This stage is critical because the define phase explores in depth the specific needs of the target readers—in this context, nutrition students who are required to demonstrate competence in the field of Food and Nutrition Data Analysis (FNDA).

3.1 Analysis of the Semester Learning Plan (RPS) for FNDA

At the Define stage, a review of the Semester Learning Plan (RPS) for the Food and Nutrition Data Analysis (FNDA) course was conducted to identify the requirements for developing teaching materials that align with literacy principles and the Quantum Teaching approach. The review resulted in the following findings:

1) Integration of Learning Outcomes (CPLs and Sub-CPLs)

The teaching materials should support the achievement of CPL-2 through CPL-6, with a focus on:

- Understanding food and nutrition data
- Preparing a coding book
- Mastery of analytical applications such as SPSS, Nutrisurvey, WHO Anthro/AnthroPlus, E-PPGBM, and Nutriclin
- Understanding qualitative research methodology

Accordingly, the teaching materials must provide conceptual narratives, applied examples, and structured exercises on data processing (coding–input–analysis) using the mentioned applications.

2) Mapping of Core Materials and Subtopics

The teaching materials should cover the following content in Table 1.

Table 1. Analysis material from Semester Learning Plan of FNDA

Core Material	Subtopics to be Elaborated
Basic concepts of food and nutrition data analysis	Definition, types of data, and the role in nutrition policy
Coding Book	Structure, preparation steps, and exercises using the <i>Riskesdas</i> questionnaire
SPSS	Data transformation, input, and univariate and bivariate analysis
WHO Anthro & AnthroPlus	Data entry, z-score calculation, and interpretation of child nutritional status
Nutrisurvey	Input of FFQ/SQ-FFQ data, dietary intake analysis, and reporting
E-PPGBM	Steps of application use and case study examples
Nutriclin	Stages of case-based nutrition care
Qualitative research	Data collection and analysis techniques

3) The teaching materials were designed by incorporating the following aspects:

- Data Literacy: Interpretation of graphs, tables, and analysis outputs.
- Quantum Teaching Elements: a) Visualization (schemes, flowcharts, and input–analysis infographics); b) Collaborative learning (group assignments); c) Interactive activities (reflective quizzes, guiding questions, discussion spaces); d) Kinesthetic activities (direct data entry simulations); e) Learning reflection: “What have I learned?” and “What is its impact on society?”
- Accordingly, the teaching materials must address the cognitive, affective, and psychomotor domains of students.

4) Alignment with Assignments and Assessments

The teaching materials must be aligned with the types of assignments and assessment methods used in the FNDA course. Specifically, they should support students in completing coding book tasks, such as defining variable indicators, labels, and values, as well as practical application exercises involving data input and analysis. In addition, the materials should facilitate student presentations, particularly those related to the use of Nutriclin and SPSS, while also providing structured support for case-based and project-based learning activities. Therefore, the development of teaching materials must incorporate clear evaluation rubrics, reporting format examples, and practice simulations to ensure consistency and transparency in the assessment process.

5) Format and Media of Teaching Materials

Considering that learning in the Nutrition Study Program is also conducted through the SIPDA online platform, the teaching materials are recommended to be provided in multiple digital formats. These include PDF modules and PowerPoint presentations for theoretical content, as well as interactive digital worksheets in Excel or Google Sheets to support coding book and Nutrisurvey practices. In addition, video tutorials—either embedded from YouTube or developed independently—should be integrated to offer step-by-step demonstrations that students can revisit at their own pace. To further enhance practical learning, template files such as .sav, .nsf, and .ant are suggested as starter files for hands-on training with analytical applications.

3.2 Student Needs Analysis in Food and Nutrition Data Analysis (FNDA)

The needs assessment for teaching materials to strengthen competencies in Food and Nutrition Data Analysis (FNDA) was conducted among a group of nutrition students who served as respondents. The quantitative results of the student survey are summarized in Table 2. In Section A (Basic Knowledge and Understanding of the Subject), students indicated a generally good understanding of fundamental FNDA concepts (mean = 3.7), but they also expressed the need for deeper explanations of theoretical foundations (mean = 4.1). Similarly, their understanding of data processing methods was moderate (mean = 3.5).

In Section B (Skills and Proficiency in Using Analytical Tools), the scores reflected limited proficiency in using analytical software (mean = 3.4), with some students reporting difficulties (mean = 2.9). However, there was a strong demand for additional training to improve mastery of these tools (mean = 4.2). For Section C (Learning Methods and Needs for Teaching Materials), students strongly agreed on the importance of more interactive and technology-based resources, such as videos, simulations, and case-based learning approaches. Both the need for practice-oriented learning (mean = 4.5) and interactive teaching materials (mean = 4.5) received the highest scores, demonstrating a clear preference for experiential learning methods.

In Section D (Challenges and Barriers in Learning), students rated their overall difficulties as moderate. Time management (mean = 3.0) and the gap between theory and practice (mean = 3.0) were noted, but they emphasized the importance of having more relevant and up-to-date materials (mean = 4.2). Finally, in Section E (Expectations for Quantum Teaching-Based Materials), students expressed strong agreement that Quantum Teaching could enhance their understanding of FNDA concepts (mean = 4.2). They also emphasized the importance of collaborative methods (mean = 3.7) and expected teaching materials to integrate techniques that could be directly applied in research or professional practice (mean = 4.5).

Table 2. Average Scores of Student Responses by Section

Section	Statement	Mean Score
A: Basic Knowledge and Understanding of the Subject	I believe I have a good understanding of the basic concepts of food and nutrition data analysis.	3.7
	I need more explanations about the fundamental theories underlying food and nutrition data analysis.	4.1
	I feel I have an adequate understanding of the methods of processing and analyzing data related to food and nutrition.	3.5

Section	Statement	Mean Score
B: Skills and Proficiency in Using Analytical Tools	I feel reasonably skilled in using software or analytical tools applied in food and nutrition data analysis.	3.4
	I find it difficult to use software or tools for food and nutrition data analysis.	2.9
	I need more training to understand how to use analytical tools relevant to food and nutrition data analysis.	4.2
C: Learning Methods and Needs for Teaching Materials	I find the current lecture materials helpful in understanding food and nutrition data analysis.	3.8
	I learn more effectively when the material is taught through practical or hands-on approaches (e.g., case studies, experiments).	4.5
	I need more interactive and technology-based teaching materials (e.g., videos, simulations, or learning applications).	4.5
	I find it difficult to manage time to study food and nutrition data analysis materials.	3.0
D: Challenges and Barriers in Learning	I perceive a gap between the theory taught in class and its practical application in food and nutrition data analysis.	3.0
	I need more relevant and up-to-date materials on food and nutrition data analysis to improve my understanding.	4.2
	I believe the Quantum Teaching approach can help me better understand the concepts of food and nutrition data analysis.	4.2
E: Expectations for Quantum Teaching-Based Materials	I prefer learning methods that involve group discussion and collaboration among students.	3.7
	I expect the teaching materials provided to include various techniques and approaches in food and nutrition data analysis that can be directly applied in professional work or research.	4.5

The qualitative findings complemented the survey results by providing detailed recommendations for improving teaching materials. Students consistently emphasized the importance of hands-on practice, including training in data collection and field analysis to bridge the gap between theory and application. They also highlighted the value of instructional videos, particularly for complex tasks such as SPSS analysis, which would allow them to review procedures multiple times at their own pace.

Another recurring theme was the need for active discussion forums, where students could engage in real-time problem-solving with peers and instructors. Respondents also suggested the development of practical and interactive teaching materials, including real case studies, simulations of food consumption surveys, and the use of authentic datasets. These strategies were expected to increase engagement and foster analytical competence.

Students also called for regularly updated materials that integrate clear, video-based learning and promote data literacy. They proposed the creation of comprehensive modules with case studies and dummy datasets, accompanied by answer keys for self-assessment. Furthermore, the inclusion of step-by-step tutorials for software tools such as SPSS, R, Excel, and Tableau was considered essential for enhancing technical proficiency. In terms of pedagogy, students recommended problem-based projects and cross-disciplinary collaboration with fields such as statistics, computer science, and public health to enrich the learning process. This reflects a demand for integrative and applied approaches in nutrition education.

Students also identified several key content areas to be incorporated into teaching materials:

- Statistics and software applications (SPSS, Excel, R) for both basic and advanced analyses.
- Specialized nutrition applications (WHO AnthroPlus, Nutrisurvey, Nutriclin, E-PPGM) for anthropometric and dietary data analysis.
- Data processing and visualization, including effective reporting and the use of public datasets such as Riskesdas.
- Nutrition epidemiology and food science, to understand dietary patterns, risk factors, and food safety.
- Food consumption analysis and nutritional requirements, to apply theory in menu planning and dietary assessment.
- Nutrition surveillance and research ethics, ensuring students acquire both technical skills and ethical awareness in handling nutrition data.

The development of comprehensive, interactive, and practice-oriented teaching materials in the context of Food, Nutrition, Dietetics, and Agriculture (FNDA) is increasingly important as modern education shifts toward digital and experiential learning. Although students in nutrition and related fields often have a solid foundation of theoretical knowledge, many lack the applied skills needed to effectively use analytical tools. This highlights the need for reforms that bridge these gaps [10], [11]. A continued reliance on traditional, theory-based teaching limits students' readiness to engage with real-world data and advanced analytical software. Previous studies also show that students commonly struggle when working with statistical applications and interpreting complex datasets [10], [12], [13].

Recent developments in higher education support these findings, demonstrating a clear demand for interactive and technology-driven learning environments. Institutions are increasingly adopting digital, blended, and experiential learning frameworks that align with students' expectations and the requirements of professional practice [12], [14], [15]. These digital transformation strategies represent a fundamental shift in educational delivery, reflecting the realities of a technologically advanced society [10], [16]. Such changes require not only the use of digital tools but also curriculum reform that emphasizes active learning approaches—including project-based and problem-based learning—that strengthen critical thinking and problem-solving skills [11].

The emphasis on interactive learning is supported by a range of studies showing that such methods encourage deeper engagement and help students build essential skills for real-world application, particularly in health sciences education [11]. For example, the use of case-based

scenarios and collaborative projects not only enhances knowledge acquisition but also develops students' ability to analyze and address practical challenges [17], [18]. Incorporating approaches that increase motivation through engaging, contextually relevant, and well-structured learning experiences is therefore vital for aligning education with both students' career goals and the evolving needs of nutrition science [11], [17].

Students' requests for broader subject integration—such as epidemiology, nutrition surveillance, and ethics—further highlight the interdisciplinary nature of nutrition studies [4], [19]. Including such topics reflects a necessary evolution in educational philosophy, ensuring that curricula equip students with a more comprehensive skill set demanded by today's employers [20]. This also points to the importance of cross-disciplinary collaboration. Connecting nutrition education with related fields such as statistics, computer science, and public health is not only beneficial but essential to address the complexities of professional practice [21], [22]. Developing teaching materials that reflect this collaborative approach will better prepare students to adapt and succeed in their future careers.

4 Conclusion

This study highlights the importance of developing literacy-based teaching materials grounded in the principles of Quantum Teaching to strengthen competencies in Food and Nutrition Data Analysis (FNDA). The findings reveal that while students possess a basic understanding of FNDA concepts, they face challenges in applying analytical tools and require more practice-oriented and technology-driven resources. Integrating interactive, case-based, and collaborative approaches into the teaching materials can help bridge the gap between theoretical knowledge and practical application.

Furthermore, the inclusion of broader topics—such as epidemiology, nutrition surveillance, and research ethics—reflects the interdisciplinary demands of the nutrition profession. The design of comprehensive and engaging teaching materials should therefore not only focus on cognitive learning but also address affective and psychomotor skills, preparing students for real-world problem-solving. In conclusion, aligning teaching materials with modern pedagogical approaches and student needs will enhance learning outcomes, increase engagement, and equip future nutrition professionals with the analytical and critical skills required to meet contemporary challenges in nutrition science.

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