Researches on Multidisciplinary Approaches Multidisipliner Akademik Yaklaşım Araştırmaları

Research Article

Researches on Multidisiplinary Approaches 2025, 5(2): 503-518 ISSN:2791-9099

Determination of Misconceptions in Cooking Methods and Chopping Techniques in Culinary Education[1]

Cevdet Sökmen* / Ph.D. Stu.
Balıkesir University, Institute of Social Sciences, Department of Gastronomy and Culinary Arts
cevdet.sokmen@bilecik.edu.tr

Mehmet Sarıoğlan / Prof. Dr.
Balıkesir University, Faculty of Tourism, Division of Gastronomy and Culinary Arts
mehmets@balikesir.edu.tr

*Corresponding Author

Abstract

This study aims to determine the misconceptions that students enrolled in the culinary program have regarding cooking methods and cutting techniques. Within the scope of the research, a three-stage misconception determination test was administered to first- and second-year students enrolled in the Culinary Program at Söğüt Vocational School. Concept maps related to the subject were prepared for the students before the test was administered. The test results were analysed in terms of general misconceptions and positive and negative misconceptions. The findings from the analysis of misconceptions showed that students had the most misconceptions about techniques such as "blanching", "braising" and "stir frying". When examining the findings on chopping techniques, the same results emerged for the concepts of "paysanne chopping", "medium dice chopping" and "oblique cuts". The high level of confidence in the answers chosen by the students indicates that the misconceptions are persistent. The results indicate the need to develop educational strategies for concept teaching in culinary education.

Keywords: Cooking Methods, Chopping Techniques, Concept Map, Culinary Education.

JEL Codes: I21, I23, D83

[1] This study was prepared based on the doctoral thesis titled "Determination of Misconceptions in Cooking Methods and Chopping Techniques" prepared at Balıkesir University.

Citation: Sökmen, C., & Sarıoğlan, M. (2025). Determination of misconceptions in cooking methods and chopping techniques in culinary education. *Researches on Multidisciplinary Approaches (ROMAYA Journal), 5*(2), 503–518.

Submission Date : 19.08.2025
Acceptance Date : 20.10.2025

1. Introduction

Culinary education is a professional training field that teaches the combined use of scientific knowledge and art, in addition to kitchen practices. Today, the culinary profession involves the use of technology in addition to practical and theoretical knowledge. Chefs must also develop their creativity alongside the use of technology. Changing sectoral conditions necessitate a certain level of transformation in culinary education. In their work, Aslan and Pekerşen (2019) emphasised that students who receive a high standard of culinary education directly add value to businesses and the sector. Similarly, Kurnaz, Kurnaz, and Kılıç (2014) stated that the quality of education is a fundamental factor affecting students' perspectives and attitudes towards the profession. These findings reveal that the quality of culinary education not only supports individual success but also supports the sustainability of the tourism and food and beverage sector.

Culinary programs are among the best examples of vocational education models that can be applied to practical education. Oğan (2022) stated that culinary programs offering associate degrees are effective in training qualified personnel and shaping students' attitudes towards the profession. However, he emphasised that there are significant differences in students' levels of readiness for working life. According to Oğan's (2022) study on "Level of Readiness for Working Life," although students possess theoretical knowledge, they perceive themselves as inadequate in certain areas. These include initiative, foreign language skills, risk-taking, and professional ethics. This result reveals that culinary education must develop not only practical skills but also communicative and cognitive competencies.

The existence of gender-based differences in the culinary education process is an important factor. Gençoğlu and Kemer (2021) showed in their study that female students pursuing a career in cooking have negative perceptions regarding gender-based barriers. However, it was found that female students have higher professional skills. This situation demonstrates the need for an approach based on equality, inclusiveness and competence in education.

Incorrect learning acquired in the workplace or during internships during the education process becomes embedded in students' subconscious. This learning becomes permanent over time. The aim of this research is to reveal misconceptions arising from incorrect learning and many other factors. Before determining misconceptions, the subject matter was explained to the students and concept maps were created. Concept maps support meaningful learning and make students' cognitive levels more visible. As a result of this application, it was observed that students' learning processes deepened and their levels of relational understanding increased. At the end of the training process, the Conceptual Misconception Determination Test developed by Sarıoğlan, A. B., Sarıoğlan, M., and Sökmen (2024) was updated and applied. The findings show that students have misconceptions about some basic concepts. This study aims to increase conceptual learning success in culinary education, strengthen students' ability to apply correct techniques, and contribute to the establishment of a science-based understanding in the culinary profession.

2. Literature Review

Chopping techniques and cooking methods constitute an important part of the curriculum in gastronomy and culinary education. Because gastronomy focuses not only on what and why is consumed, but also on how it is consumed. These two issues are decisive in terms of presentation, flavour, digestion and elimination of microorganisms. However, the naming of chopping techniques and cooking methods differ in the literature. For example, Maviş (2008) made a triple classification for cooking methods, while Aktaş & Özdemir (2012) divided them into two as wet and dry heat. Türkan (2009) and Sökmen (2011) did not make a classification. This diversity of knowledge makes it difficult to transfer knowledge to students and negatively affects the quality of education. Correct understanding of basic concepts strengthens the quality of education.

On the other hand, correct understanding of basic concepts not only improves the quality of education but also contributes to the prevention of misconceptions. Determination and elimination of misconceptions are generally dealt with intensively in the sciences. In this context, misconceptions of students at different levels in fields such as physics, chemistry, mathematics and biology are determined and various methods are applied to correct these misconceptions. As innovative teaching approaches, inquiry-based education model (Deveci, 2020; Göksu, 2011), problem-based education model (Bayram, 2010; Yılmazel, 2021; Yurd, 2007), project-based education model (Dilşeker, 2008; Seloni, 2005) and 5E-7E teaching model (Caner, 2008; Çekiç-Toroslu, 2011; Gül, 2011; Saka, 2006; Yenil, 2020; Türker, 2020) stand out. These findings in science indicate the existence of similar problems in gastronomy education. However, there are few studies addressing misconceptions in the fields of gastronomy and culinary. The case study conducted by Sarıoğlan, Avcıkurt, and Sezen (2020) is the first research on the subject in both national and international gastronomy literature. In the related study, special teaching methods were applied to eliminate misconceptions about cooking methods, and the effectiveness of these methods was evaluated.

2.1. Cooking Methods and Cutting Techniques

Cooking methods are one of the fundamental components of culinary education and aim to make food edible while preserving its sensory, nutritional and hygienic properties. Different cooking methods have been developed for this purpose. In most sources, cooking methods are subject to different classifications. Basically, a three-stage classification can be made. These are wet cooking, dry heat cooking, and other cooking methods. There are different characteristics that distinguish cooking methods from each other. These vary according to the equipment used, the heat source, and the heat level. Table 1 explains cooking methods based on their basic characteristics.

Table 1. Cooking Methods

Cooking Methods	Description	Average Temperature Value at Which the Cooking Method is Used
Boiling	Cooking food at the boiling point of water (100°C).	100°C
Blanching	The process of briefly immersing food in boiling water, followed by rapid cooling.	100°C
Simmering	Cooking food in a liquid that is gently bubbling at a temperature slightly below the boiling point.	85°C-93°C
Poaching	Cooking food in a liquid that is below the boiling point of water and gently moving.	71°C-85°C
Steaming	Cooking food using steam.	100°C
Stewing	Cooking food at a low temperature in a small amount of liquid for a long time.	85°C-93°C
Braising	This involves first searing food over high heat and then cooking it at a low temperature in a small amount of liquid.	85°C-93°C
Roasting	Cooking food in a dry heat oven.	149°C-232°C
Grilling	Cooking food over an open flame or on a grill.	177°C-288°C
Broiling	Cooking food under intense heat from above.	260°C-288°C
Baking	The process of cooking food in a closed environment in the oven using dry heat.	149°C-204°C
Deep Frying	The process of frying food by completely submerging it in oil.	163°C-191°C
Shallow Frying	This involves frying food in a small amount of oil.	177°C-191°C
Stir-Frying	Cooking food quickly over high heat with a small amount of oil, stirring constantly.	191°C-204°C
Sautéing	Cooking food quickly in a small amount of oil.	177°C-191°C
Microwave	Cooking food using microwave radiation.	Varies depending on the microwave frequency.
Sous-Vide	Cooking food in vacuum-sealed bags in a water bath at a low temperature for a long period of time.	54°C-85°C
Infrared Cooking	Cooking food using infrared rays.	260°C-482°C
Bain-Marie	The process of cooking food indirectly at a low temperature in a container filled with hot water.	Below 100°C

Source: Gisslen, W. (2015). Essentials of Professional Cooking. Hoboken: John Wiley & Sons, Inc.

Cutting techniques positively or negatively affect the cooking process. The quality of the product changes with incorrect cutting. Basic cutting techniques such as julienne, brunoise, mirepoix, paysanne, chiffonade, and bâtonnet directly shape the cooking time and flavour transfer by affecting the surface area of the food. Furthermore, the application of correct cutting techniques supports efficiency, safety, and aesthetic presentation in the kitchen. The misconceptions students encounter in cutting tasks mostly stem from mixing up measurement units, incorrectly applying knife grip techniques, or cutting pieces that do not conform to standard measurements. Therefore, conceptual awareness is as important as the repetition of motor skills in teaching cutting techniques. Teaching through visual materials, hands-on practice, and concept maps helps students integrate their cognitive and psychomotor competencies. The types of cutting techniques and measurement standards used in culinary education are detailed in Table 2.

Table 2. Cutting Techniques

Cutting Technique	Description
Tourné	Cutting products into oval and seven-sided shapes. Potatoes are particularly suitable for this cut. Products should be cut into oval shapes 5 cm long and 2 cm wide.
Large Dice Cutting	Products should be cut into large cubes. The cubes should measure 2 cm in width.
Medium Dice	Products should be cut into medium-sized cubes. The cubes should measure 12 mm in width.
Small Dice	Products should be cut into small cubes. The cubes should measure 6 mm on each side.
Brunoise	Products should be cut into small cubes. The cubes should measure 3 mm on each side.
Fine Brunoise	Products should be cut into small cubes. The cubes should measure 1.5 mm on each side.
Rondelle	Products are sliced into round pieces. Measurements vary depending on the diameter or thickness of the slice.
Paysanne	Products should be cut into square shapes. The height should be 3 mm, and the side lengths should be 12 mm.
Lozenge	Products are sliced into diamond shapes. The cutting process is performed at dimensions of 12 mm x 12 mm x 3 mm.
Fermière	Products are cut into irregular shapes. Thicknesses and diameters typically vary.
Batonnet	Products are cut into sticks. The cutting process is carried out at dimensions of 6 mm x 6 mm x 6-7.5 cm.
Julienne Cutting	Products are cut into thin sticks. The cutting process is carried out at dimensions of 3 mm x 3 mm x 6 cm.
Fine Julienne	Products are cut into thin strips. The cutting process is carried out at dimensions of 1.5 mm x 1.5 mm x 5 cm.
Oblique Cuts	Typically used for long, cylindrical vegetables. The cutting angle varies depending on the shape of the vegetable.
Chiffonade	This involves cutting leaves into thin strips. It is commonly used for lettuce and herbs.

Source: Gisslen, W. (2015). Essentials of Professional Cooking. Hoboken: John Wiley & Sons, Inc.

Cooking methods and chopping techniques must be applied correctly to achieve good results in kitchen production. In addition to teaching students the correct applications, theoretical knowledge must be taught without causing misconceptions. In this way, kitchen applications can become a learning area based not only on skills but also on scientific accuracy and cognitive awareness. This integrity also provides an important foundation for the conceptual learning process and the identification of misconceptions, which will be detailed in the next section.

2.2. Misconception

Misconceptions are the situation where students have incomplete or incorrect knowledge structures that contradict scientific facts. These misconceptions can negatively affect the learning processes of individuals and lead to the reinforcement of erroneous knowledge. Especially in areas that require both theoretical and practical knowledge such as culinary program, it is of great importance to provide correct concept knowledge. Students may develop misconceptions due to their own experiences, misinformation acquired in daily life or incomplete guidance in the educational process (Daley & Torre, 2010) .

In the context of gastronomy education, these misconceptions are particularly focused on cooking methods, food processing techniques, material properties and hygiene. For example, misconceptions such as students confusing "roasting" and "sauteing" methods or perceiving "boiling" method as a cooking process in hot water can directly affect their performance in the kitchen. When the correct learning strategies are not applied, such misconceptions may become permanent and may lead to wrong practices in the professional kitchen environment. Studies have shown that concept maps are effective in determining misconceptions. (Ökten & Seferoğlu, 2022).

2.3. Concept Maps

Concept maps are an educational method that enables students to visually convey their knowledge and learn correctly by establishing relationships between concepts. Developed by Novak and Gowin (1984), this method supports meaningful learning by establishing relationships between concepts. The concept-intensive nature of culinary education makes this method particularly suitable for use.

Concept maps reveal students' thought structures. They are widely used in science and education sciences (Daley & Torre, 2010). Studies conducted in the context of nursing education show that concept maps are effective in increasing creative thinking tendencies and supporting academic success (Ökten & Seferoğlu, 2022) .

A systematic review of the use of concept maps as an assessment tool revealed that this method is frequently preferred in engineering education to support the learning process and increase academic achievement (Şanlıtürk & Boy, 2023) . In addition, comparative studies in the fields of health sciences and diabetes education show that higher knowledge acquisition is achieved in groups using concept maps compared to traditional lectures (Wilgis & McConnell, 2008) .

Since gastronomy education is an interdisciplinary field that includes practical knowledge, it is of great importance for students to construct their conceptual knowledge. Concept maps can be considered as an effective method in teaching subjects such as food preparation techniques, hygiene practices and kitchen management. In addition, it has been observed that teaching processes with concept maps increase students' learning motivation and reduce misconceptions (Daley & Torre, 2010).

2.4. Related Research

When the studies conducted between 2001 and 2024 on the determination of misconceptions are examined, it is seen that a total of 66 theses were prepared at master's and doctoral level. Some of these theses are exemplified below:

Ünsal (2019) aimed to determine the misconceptions, knowledge deficiencies and scientific knowledge levels of prospective science teachers about gas pressure. In this direction, a four-stage Gas Pressure Misconception Diagnosis Test was developed. The findings show that the candidates' scientific knowledge levels are insufficient, and they have difficulties in giving correct answers, making explanations and trusting their answers. The study provides important contributions in terms of understanding conceptual difficulties and developing appropriate teaching strategies.

Aksoy (2022) examined pre-service science teachers' misconceptions about global warming through a four-stage diagnostic test and calculated the rates of scientific knowledge, lack of knowledge, positive false and negative false. The findings showed that pre-service science teachers had more than 10% misconceptions in each question and that their scientific knowledge of the subject was insufficient. The study reveals the need for effective teaching strategies to eliminate these misconceptions.

Şemet (2023) aimed to determine and correct the misconceptions of university students from different disciplines about the phases and eclipses of the Moon. In the study, which was designed in a determinative and descriptive manner, survey and case study methods were used together. Data were collected through a four-stage astronomy concept test based on the literature and a semi-structured interview; thus, students' misconceptions on the related topics were revealed.

Gürbüz (2023) aimed to determine the misconceptions of pre-service teachers who had taken measurement and evaluation course. For this purpose, he developed a 22-item, three-stage multiple-choice diagnostic test and applied it to 132 prospective teachers from Kocaeli University Faculty of Education. The stages of the test were structured to consist of 4, 4 and 2-choice questions, respectively.

Kartal (2017) aimed to examine pre-service science teachers' level of understanding of basic chemistry concepts and their misconceptions. The study was conducted with 260 pre-service science teachers studying at Necmettin Erbakan University. In the questionnaire consisting of two parts, the first part includes personal information, and the second part includes judgements about the evaluation of chemistry concepts of the candidates with 87 statements. The participants were given the options of "agree", "disagree" and "no idea". The data obtained were statistically analysed and misconceptions about chemistry topics were revealed in detail.

Demirci (2015) aimed to determine students' misconceptions about protein synthesis through concepts questionnaire, concept test and concept maps. In the study, the effect of concept maps in eliminating these misconceptions was compared with the traditional teaching method. In the mixed research design study, quantitative data were analysed using a quasi-experimental design with pretest-post-test control group and qualitative data were analysed using descriptive analysis. While concept map supported instruction was applied in the experimental group, traditional method was preferred in the control group. In the data collection process, various measurement tools were used to compare the level of conceptual understanding and the effectiveness of teaching methods.

Orçan (2013) aimed to examine the misconceptions of graduate students on the concepts related to the research process and the relationship between these misconceptions and research competences. A total of 110 students (58 master's and 52 doctoral students) studying at the Educational Sciences Institutes of Ankara and Gazi Universities constituted the research group. Research Concepts Test (RCT) and Cognitive-Developmental Competences in Research Scale (CDRS) were used as data collection tools. The findings showed that most misconceptions were concentrated in the concept of "test adaptation"; however, there was no significant difference according to the level of education or a significant relationship between misconceptions and competence scores.

These examples clearly show how common misconceptions are in different disciplines and the importance of studies in this field.

3. Methodology

3.1. Research Model

In this research, survey method was used from quantitative research method. In the study, it was aimed to determine the misconceptions of the 1st and 2nd year students studying in Söğüt Vocational School Culinary Program about cooking methods and chopping techniques. After the related topics were explained to the students, they were informed about the concept map method and asked to create their own concept maps. After the learning process was completed, a three-stage misconception determination test developed by the researchers was applied.

3.2. Study Group

The population of the study consists of students enrolled in culinary program at universities across Turkey offering associate degree-level culinary program education. As of 2024, there are 99 universities in Turkey offering this program, with a total student capacity of 6,373. In this context, the population of the study encompasses a fairly large group of students.

The sample of the study consists of a total of 65 students enrolled in the Culinary Program at the Söğüt Vocational School of Bilecik Şeyh Edebali University. All students enrolled in the program were included in the study. Therefore, no sampling technique was used in the sample selection process; the census method was preferred. The census method is based on the inclusion of all individuals in a specific sub-population in the study and, in this respect, eliminates sampling error.

First- and second-year students were evaluated together in the study, and no distinction was made based on class level. Although the census approach was applied in the study due to high accessibility and participation rates, the results cannot be generalised to all culinary program students in Turkey because the sample represents only one university. Nevertheless, the fact that Söğüt Vocational School's curriculum, course content, and student profile are similar to those of other state universities indicates that the findings obtained are adaptable to similar programs.

3.3. Data Collection

The data collection process in the research was carried out after several stages. Firstly, the theoretical information about cooking methods and chopping techniques was explained to the students in the classroom environment. Then, information on how to prepare concept maps was given and sample concept maps were shown. Students individually created concept maps on cooking methods and chopping techniques. After the learning process, a three-stage misconception determination test was applied to the students. The data of the study were collected in the autumn semester of the 2024-2025 academic year in the designated culinary program. All students participating in the study were included in the study on a voluntary basis. The three-stage misconception determination test developed within the scope of the research was used as a data collection tool. During the test application, the research-

er was present in the classroom as a supervisor and supervised the process. This study was ethically approved by the decision of Balıkesir University Social and Human Sciences Research Ethics Committee dated 29.11.2024 and numbered 2024/11-44 (Document Date and Number: 13.12.2024 - E.458015). The research was conducted in accordance with the decision of the relevant board and within the framework of ethical principles.

3.4. Data Analysis

The reliability of the three-stage misconception determination tests used in the study was evaluated by Kuder-Richardson (KR-20) coefficient. The KR-20 reliability coefficient was found to be 0.69 in the analysis of two tests whose first and second stages consisted of 68 items in total. This value shows that the test has a moderate level of reliability. The reliability coefficient is close to 0.70. This indicates that the test items are consistent. The difficulty level and item discrimination indices of the items included in the tests were analysed. The difficulty levels were found to range between 0.30 and 0.85. It can be said that the difficulty level of the test questions shows a balanced distribution. It was observed that a significant portion of the discrimination indices of the items in the test were above 0.20. This finding revealed that there was a meaningful level of discrimination among the participants.

The three-stage misconception determination test, which was used as a data collection tool, was structured to reveal the conceptual knowledge levels of the students and their possible misconceptions about the concepts. In the first and second stages of the test, multiple-choice questions are included, and in the third stage, students are asked to what extent they are sure of their answers. This structure allows us to analyse not only the correct or incorrect answers of the students, but also the cognitive confidence levels behind these answers.

The analysis categories in Table 3 show the criteria used in the evaluation of student responses. The fact that the students answered both questions correctly and stated that they were sure of their answers shows that they have scientific knowledge. On the other hand, students who had one correct and one incorrect answer and were not sure of their answer were included in the category of lack of knowledge. Likewise, students who gave incorrect answers at both stages and expressed indecision were also categorised as lack of knowledge. Students who gave correct answers at both stages but expressed uncertainty about their answers were categorised separately on the grounds that they might have given correct answers by guess or chance.

Misconceptions arise when a student gives an incorrect answer with high confidence. The fact that the student is confident even though his/her answer is wrong shows that he/she has a systematic false belief about the concept. In this context, those who gave correct answers in the first stage and incorrect answers in the second stage and were confident about their answers showed positive misconceptions; those who gave incorrect answers in the first stage and correct answers in the second stage and stated that they were confident again showed negative misconceptions. The students who gave wrong answers to both questions and were sure of their answers were directly in the misconception category.

This analysis approach goes beyond students' superficial knowledge levels and systematically reveals their conceptual understandings, knowledge deficiencies and misconceptions. Thus, it contributes to the planning of more targeted and effective interventions for the teaching process.

Table 3. Three Step Misconception Test Evaluation Table

Categories	Phase One Question	Second Stage Question	Third Stage Question
Scientific Knowledge	Right	Right	Sure
Lack of Information	Right	Wrong	Not sure
	Wrong	Right	Not sure
	Wrong	Wrong	Not sure
Estimated Lucky answer	Right	Right	Not sure
Misconception (Positively Wrong)	Right	Wrong	Sure
Misconception (Negatively Incorrect)	Wrong	Right	Sure
Misconception	Wrong	Wrong	Sure

Source: Arslan, H. O., Cigdemoglu, C., & Moseley, C. (2012). A three-tier diagnostic test to assess pre-service teachers' misconceptions about global warming, greenhouse effect, ozone layer depletion, and acid rain. International journal of science education, 34(11), 1667-1686.

4. Findings

4.1. Findings Related to Cooking Methods

To determine the students' conceptual knowledge and possible misconceptions about cooking methods, a three-stage test consisting of 19 items was applied. Within the scope of this test, students' prior knowledge levels, whether they recognised the concepts correctly and their confidence level in their answers were analysed for each cooking method. The questions aimed to assess the extent to which students comprehended both basic and lesser-known cooking techniques, and the possibility of misconceptions was considered in students who could not reach the correct answer or exhibited high confidence despite the wrong answer. According to the data obtained, it was observed that students confused some cooking techniques and learnt some of them incompletely or incorrectly. Below, the findings related to the results obtained from this test are presented in detail.

Table 4. Misconception Findings in Cooking Methods

Cooking Methods	Number of incorrectly selected answers in the first and second stages (n)		Number of students who were sure of the answer at the third stage (n)
	Class I	Class II	Total
Blanching	17	16	33
Braising	13	12	25
Roasting	8	9	17
Stir Frying	10	7	17
Simmering	3	11	14
Stewing	7	6	13
Grilling	5	6	11
Broiling	4	4	8
Poaching	2	4	6
Infrared	4	2	6
Sous-Vide	1	5	6
Sauteing	5	1	6
Boiling	1	3	4
Bain-Marie	2	1	3
Deep Frying	1	2	3
Shallow Fat Frying	2	1	3
Microwave	2	-	2
Steaming	-	-	-
Baking	-	-	-

In Table 4, the misconceptions of culinary program students about different cooking methods are presented based on grade levels according to the results of the three-stage concept test. The number of students who gave wrong answers in the first and second stages and the number of students who expressed that they were sure of their answers despite these answers in the third stage are given. These findings reveal students' misconceptions at conceptual level about cooking methods.

According to the results of the analysis, the highest misconception rate was observed in the "Blanching" method. Regarding this method, a total of 33 students gave wrong answers in the first two stages and stated that they were sure of their answers in the third stage despite their wrong answers. Similarly, the "Braising" method also had a high rate of misconceptions, and it was determined that 25 students had incorrect information and thought that this incorrect information was correct.

Following these two methods, a total of 17 students in "Roasting" and "Stir Frying" methods, 14 students in "Simmering" method and 13 students in "Stewing" method exhibited misconceptions. In addition, 11 students had similar misconceptions in the "Grilling" technique.

These findings show that misconceptions are not only caused by the lack of superficial knowledge, but also that students internalise misconceptions in a permanent and established way. In particular, the fact that the students who gave wrong answers in the third stage stated that they were sure of their answers reveals that these misconceptions have a strong embeddedness at the cognitive level.

On the other hand, the fact that none of the students gave wrong answers in "Steaming" and "Baking" methods shows that these basic techniques were better comprehended by the students. Similarly, it is seen that the rate of misconceptions is low in relatively more widely used methods such as Microwave. This shows that students have conceptual knowledge about basic cooking techniques and misconceptions in methods that require technical differences.

Table 5. Positive Misconception Findings in Cooking Methods

Cooking Methods	Number of correct answers in the first stage and incorrect answers in the second stage (n)		Number of students who were sure of the answer at the third stage (n)
	Class I	Class II	Total
Baking	19	20	39
Microwave	16	14	30
Boiling	17	12	29
Stewing	16	13	29
Grilling	12	15	27
Simmering	10	5	15
Roasting	9	3	12
Blanching	5	5	10
Bain-Marie	4	6	10
Deep Frying	4	5	9
Infrared	6	2	8
Poaching	4	2	6
Sauteing	5	1	6
Braising	3	1	4
Steaming	1	3	4
Sous-Vide	3	-	3
Stir Frying	2	1	3
Shallow Fat Frying	3	-	3
Broiling	1	1	2

Table 5 reveals the students' positive misconceptions about cooking methods. Positive misconception is defined as the student's preference for the wrong answer in the second stage although he/she gives the correct answer in the first stage and states that he/she is sure of his/her answer despite this. This situation shows that the student has an incomplete or erroneous thought at the conceptual level, although he/she can choose the correct information at the beginning, and that he/she continues this wrong learning with confidence.

The findings of the analyses revealed that such misconceptions were seen most intensely in the "Baking" method. A total of 39 students exhibited positive misconceptions about this method. This is followed by "Microwave", "Boiling" and "Stewing" methods respectively. These results show that although the students gave correct answers about these basic cooking techniques, they could not ground this knowledge conceptually. In particular, the high level of positive misconceptions even in methods such as cooking with microwave, which are frequently encountered in daily life, reveals that these techniques are not sufficiently reinforced conceptually during the teaching process.

In addition, a significant number of students showed similar misconceptions in methods such as "Grilling", "Simmering" and "Roasting". Although the

students were able to define these techniques correctly at the beginning, the fact that they turned to distractor options in the second stage and expressed that they were sure of their answers despite this shows that learning is superficial and conceptually fragile.

On the other hand, the low number of students showing positive misconceptions in techniques such as "Broiling", "Stir Frying" and "Shallow Fat Frying" suggests that these methods are better comprehended or involve less conceptual confusion.

Table 6. Negative Misconception Findings in Cooking Methods

Cooking Methods	Number of incorrect answers in the first stage and correct answers in the second stage (n)		Number of students who were sure of the answer at the third stage (n)
	Class I	Class II	Total
Stir Frying	8	8	16
Roasting	6	6	12
Poaching	2	4	6
Steaming	6	-	6
Broiling	2	1	3
Simmering	2	-	2
Microwave	2	-	2
Infrared	-	2	2
Shallow Fat Frying	1	1	2
Stewing	1	-	1
Braising	-	1	1
Bain-Marie	1	-	1
Deep Frying	1	-	1
Sauteing	-	1	1
Boiling	-	-	-
Blanching	-	-	-
Sous-Vide	-	-	-
Grilling	-	-	-
Baking	-	-	-

Table 6 reveals students' negative misconceptions about cooking methods. Negative misconception is defined when a student gives an incorrect answer in the first stage and states that he/she is sure of his/her answer in the third stage although he/she chooses the correct answer in the second stage. This situation shows that although the student has reached the correct answer, he/she still has a wrong conceptual model mentally and maintains this wrong idea. Therefore, even if the correct answer is given on the surface, there is a deterioration in the underlying conceptual framework.

According to the data, the most negative misconceptions were observed in the "Stir Frying" method. A total of 16 students were included in this category, which shows that this technique is not sufficiently comprehended by the students and is based on wrong foundations at the conceptual level. This was followed by the "Roasting" method, and 12 students had a similar misconception. The fact that both methods are widely used in daily life suggests that although the students know these techniques practically, they could not conceptualise them correctly in the academic context.

Other cooking methods in which negative misconceptions were frequently observed include "Steaming", "Poaching", "Broiling", "Simmering", "Microwave" and "Infrared". These findings indicate that students also have misconceptions about topics that require detailed technical knowledge.

What is particularly noteworthy is that in some of the cooking methods, although the students gave incorrect answers in the first stage and reached the correct answer in the second stage, they were still sure of their misinformation. This situation reveals that not only knowledge transfer, but also cognitive confidence and conceptual awareness should be developed in the teaching process.

On the other hand, no negative misconceptions were observed in some cooking methods such as "Boiling", "Blanching", "Sous-Vide", "Grilling" and "Baking". This reveals that students have a better grasp of these basic techniques or that these methods create less conceptual confusion.

4.2. Findings Related to Chopping Techniques

In the study, a test consisting of a total of 15 questions with a three-stage structure was applied to determine the misconceptions of the students about the verification techniques. This test assessed students' levels of recognition, differentiation, and conceptualisation of different cutting techniques. The questions were prepared in a way to cover both basic and less known techniques, and the level and structure of mislearning were analysed in line with the answers given by the students. Below, the findings from this test on cutting techniques are presented in detail.

Table 7. Misconception Findings in Cutting Techniques

Cutting Techniques	Number of incorrectly selected answers in the first and second stages (n)		Number of students who were sure of the answer at the third stage (n)
	Class I	Class II	Total
Medium Dice	7	8	15
Chiffonade	6	7	13
Large Dice	4	8	12
Oblique Cuts	6	5	11
Paysanne	7	3	10
Julienne	5	2	7
Tourné	5	2	7
Small Dice	2	3	5
Rondelle	2	2	4
Batonnet	-	3	3
Brunoise	1	1	2
Fermière	1	-	1
Fine Julienne	-	-	-
Fine Brunoise	-	-	-
Lozenge	-	-	-

Table 7 shows the misconceptions of culinary students about various chopping techniques. When the number of students who gave wrong answers in the first and second stages and the number of students who stated that they were sure of their answers in the third stage are analysed, it is seen that there is a significant level of conceptual confusion in some chopping techniques.

The highest misconception was observed in the "Medium Dice" technique. A total of 15 students in both grade levels answered this method incorrectly and at the same time stated that they were sure of their incorrect answers. This result shows that students had difficulty in defining the basic chopping dimensions and learnt the concept incorrectly. It is seen that 13 and 12 students exhibited misconceptions in "Chiffonade" and "Large Dice" techniques, respectively. This situation shows that chopping techniques, which have a similar structure, are confused with each other in the naming and visual recognition processes.

In addition, "Oblique Cuts", " Paysanne", "Julienne", "Tourné" and "Small Dice" techniques also contain a considerable number of misconceptions. Most of these techniques both show visual similarities and require detailed discrimination skills

in terms of naming. This reveals that the students could not internalise these techniques sufficiently not only practically but also conceptually.

On the other hand, fewer misconceptions were detected in simpler or more frequently encountered techniques such as "Rondelle", "Batonnet" and "Brunoise". In addition, the fact that there were no wrong answers for techniques such as "Fine Julienne", "Fine Brunoise" and "Lozenge" suggests that students have clearer knowledge on these subjects.

Table 8. Positive Misconception Findings in Cutting Techniques

Cutting Techniques	Number of correct answers in the first stage and incorrect answers in the second stage (n)		Number of students who were sure of the answer at the third stage (n)
	Class I	Class II	Total
Lozenge	26	18	44
Fermière	13	10	23
Small Dice	12	8	20
Fine Brunoise	9	7	16
Oblique Cuts	12	3	15
Brunoise	7	4	11
Large Dice	4	5	9
Tourné	5	3	8
Julienne	4	3	7
Batonnet	4	3	7
Fine Julienne	4	3	7
Medium Dice	4	2	6
Rondelle	-	4	4
Paysanne	-	2	2
Chiffonade	1	-	1

Table 8 shows the cases where students exhibited positive misconceptions about chopping techniques. Such misconceptions were analysed through the cases where the students gave the correct answer in the first stage but chose the wrong option in the second stage and stated that they were sure of their answer in the third stage. This situation shows that although the students answered the question correctly, their mental structures related to the related concept were weak and unstable, and their learning remained superficial.

According to the data, the most positive misconceptions were observed in the "Lozenge" technique. A total of 44 students exhibited a positive misconception in this method and stated that they were sure of their answer. This result shows that the related concept may have been chosen correctly by the students only intuitively or accidentally, but it was not sufficiently internalised at the conceptual level.

The following techniques include "Fermière", "Small Dice", "Fine Brunoise" and "Oblique Cuts". Since these techniques may have similarities especially in terms of appearance, they are open to conceptual confusion. In addition, it is understood that students do not have a clear knowledge about naming, classifying and distinguishing these techniques.

Although relatively low levels of positive misconceptions were observed in other chopping techniques, it is still noteworthy that students had conceptual uncertainties about these techniques. In particular, the low numbers that are sure of the correct answer suggest that the students reached the correct answer with an approach based on rote memorisation or chance, rather than based on concept.

Table 9. Negative Misconception Findings in Cutting Techniques

Cutting Techniques	Number of incorrect answers in the first stage and correct answers in the second stage (n)		Number of students who were sure of the answer at the third stage (n)
	Class I	Class II	Total
Chiffonade	7	6	13
Rondelle	6	5	11
Julienne	3	7	10
Brunoise	2	3	5
Small Dice	2	1	3
Paysanne	2	1	3
Batonnet	1	2	3
Large Dice	-	2	2
Fine Julienne	1	-	1
Medium Dice	-	1	1
Oblique Cuts	-	-	-
Fermière	-	-	-
Fine Brunoise	-	-	-
Tourné	-	-	-
Lozenge	-	-	-

Table 9 presents the cases in which students exhibited negative misconceptions about chopping techniques. This type of misconceptions refers to the situations in which students answer the question incorrectly in the first stage, choose the correct answer in the second stage, but still state that they are sure of the answer in the third stage. This situation shows that students may have reached the correct answer without understanding the concept; in other words, their conceptual awareness is not developed, and they have confidence in their wrong knowledge.

According to the data, the chopping technique with the highest number of negative misconceptions was "Chiffonade". A total of 13 students first gave an incorrect answer in this method and then chose the correct answer but stated that they were sure of their answer. This situation shows that the related concept has not been sufficiently internalised by the students in terms of both terminology and practice.

Similarly, a high number of negative misconceptions were found in the "Rondelle" and "Julienne" techniques. Other techniques with negative misconceptions include less complex chopping techniques such as "Brunoise", "Small Dice", "Paysanne", "Batonnet", "Large Dice", which shows that even basic concepts are sometimes mis learnt, and students can rely on these misconceptions. In some techniques, no negative misconceptions were detected.

5. Discussion and Conclusion

This study determined the conceptual knowledge levels of students in culinary program education regarding cooking methods and chopping techniques. Conceptual misconceptions were examined through a three-stage conceptual misconception identification test. The findings show that students have learned certain techniques incorrectly or incompletely at a conceptual level in both cooking and chopping. All misconceptions were observed at a high level, particularly in techniques such as "blanching", "braising" and "stir frying". This indicates that, in addition to practical training, students have deficiencies at the conceptual level. The fact that students reported high confidence despite their incorrect answers indicates that these misconceptions are not superficial but cognitively embedded, emphasising the importance of conceptual teaching strategies.

When examining findings related to cutting techniques, conceptual misunderstandings were observed in basic cutting techniques. Students particularly confused concepts in cutting techniques with similar visuals. These results indicate that students memorised concepts and had weak associations during the application stage. Although they performed correctly in the first stage of the tests,

they made incorrect choices in the second stage. The tests revealed that answers were intuitive and that knowledge was not retained. To address these issues, an instructional approach based on observation-based education and practical assignment techniques can be applied to students.

The findings indicate that culinary education is not merely a process of acquiring skills, but also a process of conceptual thinking and cognitive structuring. Students' misconceptions regarding cooking and cutting techniques can be addressed both practically and theoretically. In this regard, integrating methods such as concept maps, structured feedback, comparative application, and error analysis-based teaching into the learning process can be effective in reducing misconceptions. Furthermore, reflective learning techniques that enable students to identify their own learning errors should also be used in the teaching process. These methods help students recognise their misconceptions and restructure them with correct scientific knowledge.

Research findings reveal that culinary education should be approached holistically. The relationship between cooking methods and cutting techniques is important not only in terms of technical application but also in terms of cognitive integrity and professional competence. In this context, incorporating concept-based teaching models into curriculum design will deepen the learning process, thereby increasing both students' academic achievement and their performance in the sector. Furthermore, comparative studies of culinary program at different universities in future research may offer a more comprehensive perspective on the causes of misconceptions.

5.1. Misconceptions about Cooking Methods

The test results revealed that the methods in which students had the most misconceptions related to cooking were 'Braising' and 'Blanching'. A total of 33 students in the "Blanching" technique and 25 students in the "Braising" technique gave wrong answers in the first two stages and stated that they were sure of their mistakes in the third stage. This finding shows that the students have not only a lack of knowledge about these methods, but also permanent and established misconceptualisations.

Following these two methods, 17 students each showed misconceptions in "Roasting" and "Stir Frying" techniques, 14 students in "Simmering" method and 13 students in "Stewing" method. On the other hand, no misconceptions were detected in "Steaming" and "Baking" methods.

The fact that the students gave the correct answer in the first stage and chose the wrong answer in the second stage and stated that they were sure despite this reveals a positive misconception. This misconception was mostly seen in the "Baking" technique. A total of 39 students showed positive misconceptions in this method. This was followed by "Microwave", "Boiling" and "Stewing" methods respectively. These results show that even if the students reached the correct answer, they could not fully internalise these methods at the conceptual level.

In the negative misconception, students should give a wrong answer in the first stage and a correct answer in the second stage and still be sure of their answer. This misconception was mostly observed in the "Stir Frying" method; a total of 16 students were in this category. This was followed by the "Roasting" method. In addition, a certain number of negative misconceptions were identified in techniques such as "Steaming", "Poaching", "Broiling", "Simmering", "Microwave" and "Infrared". On the other hand, no negative misconceptions were observed in "Boiling", "Blanching", "Sous-Vide", "Grilling" and "Baking" methods.

5.2. Misconceptions about Chopping Techniques

The highest misconception in chopping techniques was seen in the "Medium Dice" technique, and a total of 15 students answered this method incorrectly and stated that they were sure of their answer. This was followed by "Chiffonade" and "Large Dice" techniques. It is seen that students often confuse the techniques that are visually similar, and conceptual separation is not fully achieved.

Positive misconceptions were mostly observed in the "Lozenge" technique; a total of 44 students initially chose the correct answer in this method, but in the second stage they chose the wrong answer. This situation was followed by techniques such as "Fermière" with 23 students, "Small Dice" with 20 students and "Fine Brunoise" with 16 students. This shows that even if the students reached the correct answer, they recognised these concepts at a superficial level but did not have a complete conceptualisation mentally.

Negative misconceptions were mostly observed in the "Chiffonade" technique; a total of 13 students were in this category. This was followed by "Rondelle" and "Julienne". The fact that negative misconceptions can be seen even in simpler techniques such as "Brunoise" or "Small Dice" shows that students can occasionally mis learn even basic concepts and rely on these misconceptions.

The findings obtained show that students have permanent, systematic and highly confident misconceptions in both cooking methods and chopping techniques. It is understood that the ability to make conceptual distinction is weak, especially in visually similar or closely named techniques.

This situation reveals that only practical teaching is not sufficient; teaching strategies based on conceptual learning and supporting cognitive structuring are needed. It is thought that a teaching process supported by methods such as concept maps, comparative visual contents, peer interaction and structured feedback can be effective in reducing these misconceptions.

In addition, the systematic use of three-stage diagnostic tests in culinary education can be a powerful tool for determining misconceptions and restructuring the teaching process accordingly. Thus, students' professional competences can be developed at both practical and conceptual levels. Furthermore, concept misunderstanding identification tests can be systematically used in culinary education. This enables the development of students' professional competencies at both the practical and conceptual levels.

Acknowledgments

This work is delivered from the first author's ongoing doctoral thesis.

References

Aksoy, A. C. (2022). Fen Bilgisi Öğretmen Adaylarının Küresel Isınma Konusundaki Kavram Yanılgılarının Belirlenmesi. Yayımlanmamış Doktora Tezi, Hacettepe Üniversitesi, Ankara.

Aktaş, A., & Özdemir, B. (2012). Otel İşletmelerinde Mutfak Yönetimi. Ankara: Detay Yayıncılık.

Arslan, H. Ö., Cigdemoglu, C., & Moseley, C. (2012). A Three-Tier Diagnostic Test to Assess Pre-Service Teachers' Misconceptions About Global Warming, Greenhouse Effect, Ozone Layer Depletion, And Acid Rain. International journal of science education, 34(11), s. 1667-1686.

Aslan, N., & Pekerşen, Y. (2019). Aşçılık Eğitimi ve Sektör Başarısı Arasındaki İlişkinin Değerlendirilmesi: Beş Yıldızlı Otel İşletmelerinde Çalışan Aşçılar Üzerine Bir Araştırma. Celal Bayar Üniversitesi, Sosyal Bilimler Dergisi, 17(2).

Bayram, A. (2010). Probleme Dayalı Öğrenme Yönteminin İlköğretim 5. Sınıf Öğrencilerinin Fen ve Teknoloji Dersi? Isı ve Sıcaklık? Konusunda Sahip Oldukları Kavram Yanılgılarını Gidermede Etkisi. Yayınlanmamış Yüksek Lisans Tezi, Selçuk Üniversitesi, Konya.

Caner, S. (2008). Canlıların Sınıflandırılması Konusunda Bilgisayar Destekli Materyal Geliştirilerek 5e Modeline Uygulanması ve Kavram Yanılgılarını Gidermedeki Etkinliği. Yayımlanmamış Yüksek Lisans Tezi, Balıkesir Üniversitesi, Balıkesir.

Daley, B. J., & Torre, D. M. (2010). Concept Maps in Medical Education: An Analytical Literature Review. Medical education, 44(5), s. 440–448.

Demirci, T. (2015). Biyokimya Dersi "Protein Sentezi" Konusunda Kavram Haritalarına Dayalı Öğretim Yöntemi Kullanımının Öğrencilerin Başarılarına, Kavram Yanılgılarının Belirlenmesine ve Giderilmesine Etkisi. Yayımlanmamış Doktora Tezi, Atatürk Üniversitesi, Erzurum.

Dilşeker, Z. (2008). Fen ve Teknoloji Dersinde Proje Tabanlı Öğrenme Yöntemi Kullanımının İlköğretim 5. Sınıf Öğrencilerinin Fen ve Teknoloji Dersine Yönelik Tutumlarına, Ders Başarısına ve Kavram Yanılgılarının Giderilmesine Etkisi. Yayınlanmamış Yüksek Lisans Tezi, Dokuz Eylül Üniversitesi, İzmir.

Djanette, B., & Fouad, C. (2014). Determination Of University Students' Misconceptions About Light Using Concept Maps. Procedia-Social and Behavioral Sciences(152), s. 582-589.

Gençoğlu, H. U., & Kemer, E. (2021). Aşçılık Programında Okuyan Kadın Öğrencilerin Mesleğe Bakış Açılarının Değerlendirilmesi: Hatay Mustafa Kemal Üniversitesi Örneği. Aydın Gastronomy, 5(2), 105-116.

Gisslen, W. (2015). Essentials of Professional Cooking. Hoboken: John Wiley & Sons, Inc.

Gül, Ş. (2011). 5e Modeline Dayalı Olarak Hazırlanan Ders Yazılımının Öğrencilerin Başarılarına, Tutumlarına ve Kavram Yanılgılarının Giderilmesine Etkisi. Yayımlanmamış Doktora Tezi, Atatürk Üniversitesi, Erzurum.

Gürbüz, S. (2023). Öğretmen Adaylarının Ölçme Araçlarının Nitelikleri Konusuna Yönelik Kavram Yanılgılarının Belirlenmesi. Yayımlanmamış Yüksek Lisans Tezi, Kocaeli Üniversitesi, Kocaeli.

Kartal, M. (2017). Fen Bilgisi Öğretmen Adaylarının Bazı Kimya Kavramlarını Anlama Seviyeleri ve Kavram Yanılgılarının Belirlenmesi. Yayımlanmamış Yüksek Lisans Tezi, Necmettin Erbakan Üniversitesi, Konya.

Kurnaz, A., Kurnaz, H. A., & Kılıç, B. (2014). Önlisans Düzeyinde Eğitim Alan Aşçılık Programı Öğrencilerinin Mesleki Tutumlarının. Muğla Üniversitesi, Sosyal Bilimler Enstitüsü Dergisi(32), 41-61.

Maviş, F. (2008). Endüstriyel Yiyecek Üretimi. Ankara: Detay Yayıncılık.

Novak, J. D., & Gowin, D. B. (1984). Learning How To Learn. Cambridge University Press.

Oğan, Y. (2022). Aşçılık Öğrencilerinin Mesleki Beklentileri Üzerine Bir İnceleme. Afyon Kocatepe Üniversitesi, Sosyal Bilimler Dergisi, 24(4), 1621-1632.

Oğan, Y. (2022). Üniversite Öğrencilerinin İş Hayatına Hazır Bulunma Düzeyi: Aşçılık Programı Üzerine Bir Araştırma. Ankara Hacı Bayram Veli Üniversitesi Turizm Fakültesi Dergisi, 25(1), 1-18.

Orçan, B. (2013). Lisansüstü Eğitim Programlarında Öğrenim Gören Öğrencilerin Bilimsel Araştırma Sürecindeki Kavram Yanılgılarının Belirlenmesi. Yayımlanmamış Yüksek Lisans Tezi, Ankara Üniversitesi, Ankara.

Ökten, Ç., & Seferoğlu, E. G. (2022). Hemşirelik Eğitiminde Kavram Haritası Kullanımının Yaratıcı Düşünme Eğilimleri ve Akademik Öz-Yeterlik Düzeyine Etkisi. Sağlık Bilimleri Dergisi, 31(2), s. 229-234.

Saka, A. (2006). Fen Bilgisi Öğretmen Adaylarının Genetik Konusundaki Kavram Yanılgılarının Giderilmesinde 5e Modelinin Etkisi. Yayımlanmamış Doktora Tezi, Karadeniz Teknik Üniversitesi, Trabzon.

Sarıoğlan, A. B., Sarıoğlan, M., & Sökmen, C. (2024). A Research Non-Formal Gastronomy Education on Removing Misconceptions by Concept Mapping Method. Livre de Lyon.

Sarıoğlan, M., Avcıkurt, C., & Sezen, T. S. (2020). Gastronomi Eğitiminde Kavram Yanılgıları. Journal Of Tourism And Gastronomy Studies, 8(4), s. 3408-3425.

Seloni, Ş. R. (2005). Fen Bilgisi Öğretiminde Oluşan Kavram Yanılgılarının Proje Tabanlı Öğrenme ile Giderilmesi. Yayınlanmamış Yüksek Lisans Tezi, Marmara Üniversitesi, İstanbul.

Sökmen, A. (2011). Yiyecek Ve İçecek Servisi. Ankara: Detay Yayıncılık.

Şanlıtürk, D., & Boy, Y. (2023). Concept Map and Traditional Lecture-Based Teaching Method in Increasıng The Diabetes Knowledge Level. TOGÜ Sağlık Bilimleri Dergisi, 3(2), s. 117-127.

Şemet, A. F. (2023). Üniversite Öğrencilerinin Ay'ın Evreleri ve Tutulmalar Konusunda Alternatif Kavramlarının Belirlenmesi ve İyileştirilmesi. Yayımlanmamış Yüksek Lisans Tezi, Gazi Üniversitesi, Ankara.

Toroslu, S. Ç. (2011). Yaşam Temelli Öğrenme Yaklaşımı ile Desteklenen 7e Öğrenme Modelinin Öğrencilerin Enerji Konusundaki Başarı, Kavram Yanılgısı ve Bilimsel Süreç Becerilerin Etkisi. Yayımlanmamış Doktora Tezi, Gazi Üniversitesi, Ankara.

Türkan, C. (2009). Mutfak Hizmetleri Yönetimi. Ankara: Sistem Ofset.

Türker, A. A. (2020). Varyasyon Teorisi ve 5e Öğretim Modeli 'Ne

Göre Geliştirilen Öğrenme Ortamlarının Alan Kavramına Yönelik Başarı ve Kavram Yanılgılarına Etkileri. Yayımlanmamış Yüksek Lisans Tezi, Giresun Üniversitesi, Giresun.

Ünsal, A. A. (2019). Fen Bilgisi Öğretmen Adaylarının Gaz Basıncı Konusundaki Kavram Yanılgılarının Belirlenmesi. Yayımlanmamış Yüksek Lisans Tezi, Hacettepe Üniversitesi, Ankara.

Wilgis, M., & McConnell, J. (2008). Concept Mapping: An Educational Strategy to Improve Graduate Nurses' Critical Thinking Skills During a Hospital Orientation Program. The Journal of Continuing Education in Nursing, 39(3), s. 119–126.

Yenil, T. (2020). 6. Sınıf Öğrencilerinin Ondalık Gösterim Konusundaki Kavram Yanılgılarının 5e Modeline Göre Tasarlanan Dijital Kavram Karikatürleri ile Giderilmesi. Yayımlanmamış Yüksek Lisans Tezi, Bartın Üniversitesi, Bartın.

Yılmazel, A. (2021). Ortaokul Öğrencilerinin Isı ve Sıcaklık Konusundaki Kavram Yanılgılarını Gidermede Probleme Dayalı Öğrenme Yönteminin Etkisi. Yayınlanmamış Yüksek Lisans Tezi, Mersin Üniversitesi, Mersin.

Yurd, M. (2007). İlköğretim 5. Sınıf Fen Ve Teknoloji Dersinde Probleme Dayalı Öğrenme Yöntemi İle Bil-İste-Öğren Stratejisi Kullanılarak Geliştirilen Bil-İste-Örnekle-Öğren Stratejisinin Öğrencilerin Kavram Yanılgılarının Giderilmesine Ve Derse Karşı Tutumlarına Etkisi. Yayınlanmamış Yüksek Lisans Tezi, Mustafa Kemal Üniversitesi, Hatay.