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## Science behind Thai Cuisine: Applied Science to Teach Thai Cooking

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### Abstract

Thai foods had become well-known and came up on top ranking for years continually. The promotion of teaching methodology and pathway to train how to cook Thai foods with the concept of “**Good practice: Science behind Thai Cuisine**” was important, in order to support the STEM Education and to train the students to gain critical thinking, by the way they should have gain solving problems’ skill about cooking Thai foods in future. The objective of the research was to 1) analysis the scientific theory related to the Thai cuisine. 2) Thai food recipes development with scientific explanation, and 3) Implementation the recipes had studied with the students. The populations were 237 students who registered to study and training the course about Thai cooking for business. Questionnaire was used for data collection. Frequencies, percentage, mean and standard deviation was used for data analysis.

The result of the study revealed into 3 parts; 1. There were 16 theories of “Science behind Thai cuisine”, by analytical scientific theory related to the Thai cooking methodology from the body knowledge of science, such as; 1) Biology and bacteria for cooking. 2) Chemistry; osmosis, reaction of acid and base, 3) Physic; matter particularities and heat. Also found the theories about the balance of taste and the combination of ingredient in Thai cuisine was important and necessary for teaching process for the student to understand and learn, in order to become a professional Thai chef in future. 2. 26 recipes of Thai dishes were found, such as; starters, one dish meal, soup, curry and stir fried, also snack, dessert and beverage. The recipes development was explained with scientific methods to show cooking methodology for Thai delicious foods and professionally for household and businesslike cooking. 3. The result of teaching implementation of the recipes had studied found that, the teaching cooking Thai foods with scientific explanation, known as “Science behind Thai cuisine” had improved critical thinking ability for the students, they had learned and improved thinking process of critical expression, they have fun and enjoy the class, the teaching technique and methodology was not boring, they also learned teaching techniques to memorized the recipes a lot more easily, they had more confident to analysis and believed from the lessons that they would be able to solved such problems from cooking Thai foods by using scientific methods in future. They had gained confidence to cook in businesslike in future. Conclusion; Thai foods become well-known, Thai foods’ business had established more and more abroad, eating good Thai foods bring happiness and experiences, education and well train for cooking the right Thai foods and taste with the education transformation of knowledge and career is important for all. The recommendation:

1) research in order to promote Thai cuisine to be known as “Science and Art of High level Thai cuisine” is important and necessary. 2) Thai government and stakeholders sectors needed to promote Thai cuisine as the World heritage of human culture and creation is necessary.

**Keyword:** Apply science, Teaching and learning Technique, Thai cuisine

## **Introduction**

Thai foods had become well-known and came up on top ranking of the world's best foods for years continually.

The World's ranking of best foods By CNNGo staff and yonderbound group had announced for years continually (<https://yonderbound.com/blog/20-best-countries-world-food/2015> and <http://travel.cnn.com/> 2013). Many Thai dishes were accepted and announced as very good foods and were recommended to eat, such as; **Massaman curry**, (Emphatically the king of curries, and perhaps the king of all foods. Spicy, coco nutty, sweet and savory, it had combination of flavors. **Tom yum goong**, (hot and spicy prawn soup), **Pad Thai** (Stir-fried Thai noodle), **Gang Keow Wan** (green curry), **Nam tok moo** (grilled beef salad), **Kai Pad med ma-moung** (Stir-fried chicken with cashew nut), **Som tam** (raw papaya salad) and so on. The country of Thailand was known as “The Land of Smiles” wasn't just a marketing catch-line, but with high performs hospitality and friendly of Thai people. It was also a result of being born in a land of tropical climate with such varieties of fruits and vegetable, where the world's most delicious food was sold on nearly every street corner as well. The government of Thailand also realized to promote “Thai foods to the World” and “Thai kitchen to the World”, and then The Thai National Innovation Agency, 2013, had launched budget to promote such projects development, including “Thai kitchen to the World”. Five years plan was launched to be done during 2017 – 2021 (The office of Thai National Innovation, 2014). The promotion of teaching methodology and pathway to teach and train how to cook Thai foods with the concept of “**Good practice: Science behind Thai Cuisine**” was important, in order to support the STEM Education and to train the students, included the restaurant owners to gain critical thinking, by the way they should have gain solving problems' skill about cooking Thai foods in future.

## **The objective**

The objective of the research was to

1. To analysis the scientific theory related to the Thai cuisine.
2. Thai food recipes development with scientific explanation.
3. Implementation the recipes had studied with the students.

## **Expected benefit**

1. The research would have been an innovation of teaching methodology, in order to enhance critical thinking, learn and teaching process, in order to support STEM Education, emphasize in Home Economics field of study and restaurant management.

2. The research aimed to provide new teaching methodology in Thai cooking with critical thinking with logic and scientific explanation, by using technique and theory, instead of using secrete without any explanation.
3. The research would have value added to the Thai cuisine teaching method and to show the valuable of Thai cuisine as the “World heritage of Thai eating culture”.

### **Theory support the studies**

**Theory** is the relation of thinking and idea logically, that is able to explain phenomenon and occurrence which indicate the relation of such variables. Theory provides an explanation of framework for some observation and assumption. (<http://guru.sanook.com/search/knowledge> and <http://th.wikipedia.org/wiki>).

### **Intellection process in scientific method**

There are 7 process to find-out intellection process in scientific method, such as; 1) Observation the valuable situation that worth to study, 2) State the problem that may be able to investigate, 3) State the hypothesis for the study, 4) State the methodology to study and find-out the solution, 5) Set the study process and experiment, and then record the result of study, 6) Analyze the data comparison with the hypothesis and 7) Synthesize and conclusion the find-out and the study in order to transmit for further study witch would be benefit to the human being and social (<http://summary-of-science.blogspot.com/2010/08/2.html>). Also (Christopher Pappas, 2014) had written about “The 7 Steps of eLearning Course Preparation Process” needed to 1) Set goals, 2) Gather resources, 3) Define concepts, 4) Map out the eLearning course, 5) Research target audience, 6) Set expectations and assign project responsibilities and 7) Create an in-depth course description and syllabus

Pure science is a science depending on deductions from demonstrated truths, such as mathematics or logic, or studied without regard to practical applications (oxford dictionary). This study emphasize on the three branches of science; such as 1) Biology is the body knowledge of living things and bacteria, 2) Chemistry is the body knowledge related to the transformation, reaction and interaction of matter and heat, 3) Physics is the body knowledge related to the physical transformation of matter and heat (<http://th.wikipedia.org/wiki/วิทยาศาสตร์><http://sucheme1327.blogspot.com>)

### **Methodology**

The population was 237 subject matter, (lecture in Thai and English in Thailand and abroad) such as;

- 1) 73 bachelor degree students in the major field of Home Economics Education had studied in the course of Home Economics in Business, within four courses of four semesters (separated group).

2) 68 master degree students in the major field of Home Economics had studied in the course of Small Business in Home Economics, within four courses of four semesters (separated group).

3) 96 cooks, chefs and restaurant owners who registered to study the course of or Gastronomy and restaurant management, within three courses between 2014 - 2016. (Separated group).

### **Tool and research methodology**

- 1) 26 recipes of Thai dishes, such as; starters, one dish meal, soup, curry and stir fried foods, also snack, dessert and beverage was used for teaching material.
- 2) Questionnaire was used for data collection.

### **Statistic for data analysis**

Frequency, percentage, means and standard deviation was used for data analysis.

### **Result**

The result of the study revealed into 3 parts;

**Part 1** There were 16 theories of "Science behind Thai cuisine", by analytical scientific theory related to the Thai cooking methodology from the body knowledge of science, such as;

1. **Biology and bacteria for cooking**, for example; 1) the qualification of gum's tree, base, (papaya gum or pineapple gum) supported meat tenderizer, but it's difficult to control the amount of using natural agent, and then we can substituted with sodium bicarbonate or baking powder (base) for marinate meat or pork to become tender. (The ratio; 2 teaspoons of baking powder for a half kilogram of pork or meat, and then soak for 15 minutes). 2) There are two type of bacteria; aerobic bacteria and anaerobic bacteria. We supposed to use aerobic bacteria for food fermentation and food preservation, such as fermented pork, ferment meat and fermented fish (fish sauce). 3) Adding starch or sugar (carbohydrate) for fermenting food, because carbohydrate is food for bacteria. 4) Cooking food that contained vitamin A needed to add fat, because vitamin A dissolve in fat and human body needed it (functional food).

2. **Chemistry**; is the body knowledge related to the transformation, reaction and interaction of matter and heat, for example; 1) **osmosis** reaction, is the passage of solvent gone through membrane of more concentrate matter, for example, when we boil any kind of bean we need to cook until bean became cooked, before add sugar, if not the concentrate syrup will has difficulty to osmosis into the membrane of bean, and then the bean will be difficulty to cook. 2) To prevent cooking squash that will not become too soft, we were taught to soak in water that contain with calcium bicarbonate to harden the squash, but if we use reversed osmosis technique by cooking coconut milk with sugar and balance the taste with a little bit of salt, and then add squash cook for 10 minutes, the squash will cook and not become too soft. 3) Thailand is in tropical climate (warm weather, caused egg became as old egg easily), osmosis reaction, the egg white would osmosis to the egg yolk, when we boil egg, egg yolk will sink and stick eggshell and won't come out nice to serve. 4) Cooking Thai food or dessert may use the

technique of caramelized to get color and aroma from the cooking sugar in the heat. 5) Coching peanut with the technique can be use crystallization of sugar. 6) Before making food preservation, drying vegetable, we may soak vegetable and salt to dehydrate water from vegetable before drying in the Sun would have saved time used. 7) Ashes from burned pot, may solve the problem by boiling vinegar for 10 minutes, and then will be easier to clean (Technique of reaction of acid and base) 8) Cooking and serving Thai food with acerbity flavor (base) helped to adjust the stomach with high acidity, which had caused sickness in somebody (serving food as medicine, Thai traditional foods and curing). 9) Beverage made from butterfly pea's flower, gave blue color. Syrup needed not to boil, because heat would have turned syrup to become light brown color, if we mix with blue, will get green color (Theory of Color Particularities), and then we had to blend sugar with drinking water, to get clear white syrup, and able to solve those problem. 10) Cooking Thai curry always cooked coconut until became oily, and then add chili paste (chili paste contained with many different kind of herb and spice), oil particularity dissolve aroma form herb and spice, then the foods would have contained nice aroma and the right flavor.

**3. Physic;** is the body knowledge related to the physical transformation of matter and heat, for example; 1) To solve the problem of boiling old egg, by adding egg in hot water (approx. 80 degrees Celsius) and stir egg gently (Theory of Centrifugation), egg yolk will ran to the meddle, and then continue cook another 12 minutes or until cook. 2) Boiling sagu (tapioca ball) with the technique of latent heat from boiling water soaked for 1 – 2 hours, and then boil later, prevented the pressure of boiling water damage sagu's surface, but the hot water would have conduction heat to make sago cooked slowly. This method would have prevented glue water from the starch to damage public draining water, and save energy to boil sago, also protect the Global warming as well. 2) Thai sweet always made from starch, coconut milk, and sugar, in order to make good consistency of batter, we needed to use technique of gelatinization, meant to let the mixture stand for at least 15 minutes, the result of sweet will be cooked better and become success for cooking Thai sweet. 3) Chlorophyll from leaf, if had cooked with high heat for a long time, chlorophyll will precipitate and won't provide green color to the food. This technique had helped to cook rice with pandanus leaf to add light green color and aroma in steam rice. 4) To preserve aroma from preparing herbal beverage, we needed to cover the lid of pot, because boiled water will change to become steam and take away the aroma.

The study also found the theories about the balance of taste and the combination of ingredient in Thai cuisine was important and necessary for teaching process for the student to understand and learn, in order to become a professional Thai chef in future, such as;

- 1. Theory of Nutrition** in order to provide foods to maintain healthy life for the consumers (<http://nutrition.anamai.moph.go.th/temp/main/index.php>) such as; 1) Chef who was cooking and providing each meal to the consumer, needed to know and understand that human needs enough food nutrition which contained food composition of; carbohydrate, protein, fat, mineral and vitamin. 2) Some kinds of food composition had contained functional food as well, such as vitamin. 3) Some patients needed to control some food composition, such as, the patient with nephropathy, must control food with

high sodium and so on. 4) Food allergy, such as, somebody could not take peanut, gluten or seafood, and then the chef needed to concern to provide ingredients knowledge in such menus, before serving food for the customer / consumer to understand and be careful, in order to prevent trouble.

**2. Theory of Sanitation and Hygiene**, Chef and food services needed to concern and be awareness, because the World population had increased all the time, such kinds of disaster, serious diseases, cross contamination and sickness had damaged to the World citizen continually. (<http://www.foodsanitation.bangkok.go.th/foodsanitation/home.php>), such as; 1) Bird flu disease, still spread in Asia, cooking poultry and egg needed to cook well done, such as, cooked at least 72 degrees Celsius, in order to kill bacteria that cause sickness to human. 2) Avoid using raw egg to make mayonnaise. 3) Always separate using cutting / chopping board, in order to prevent any kind of cross contamination from bacteria.

Cooking Thai food normally needed to add food additive, and then in order to cook delicious Thai foods needs to understand two more theory, such as;

**1. Balance of taste theory**, in Thai cuisine always had been taught and trained that, in order to cook foods with good taste, the chef needed to concern about the balance of taste. There are seven different kinds of taste in Thai foods, such as; salty, sour, hot from chili, herb and spice, sweet (to balance the taste), bitter, acidity and rich flavor from nut and coconut milk.

**2. Combination of ingredient and taste in Thai foods**, Thailand country located in tropical climate which suitable for such different kind of fruits, vegetable, herb and spice can be grown in Thailand, as well as mineral contain in the soil and moisture in the air. Thailand also had such cooking ingredients indicated as Geographical Indications (GI), direct geographical indication and indirect geographical indication, which had linked to the quality and uniqueness of such cooking ingredients to make Thai food, came out as human needed. Beside the folk wisdom of Thai cuisine had shown the smart method of mixing such in gradients to create so many different kinds of dishes, also the cooking technique, nice and beautiful serving as well. ([http://www.ipthailand.go.th/ipthailand/index.php?option=com\\_content&task](http://www.ipthailand.go.th/ipthailand/index.php?option=com_content&task))

## **Part 2**

The result of analytical scientific theory related to the Thai cooking method had found 26 recipes of Thai dishes, such as; starters, one dish meal, soup, curry and stir fried, also Thai snack, dessert and beverage. The recipes development was explained with scientific methods to show cooking methodology for Thai delicious foods and professionally for household and businesslike cooking, as the following;

1. 4 menus of **Starter**; Krathong thong, Lab, Yam Neur yang and Yam wun sen
2. 3 menus of **One dish meal**; Pad Thai, Mussel pancake and Fermented pork fried rice
3. 3 menus of **Soup**; Tom yam kung, Tom Kha kai and Kang Jeud

4. 4 menus of **Curry**; Massaman curry with beef, Green curry with chicken, Chu-chee pla and Pha-nang pork
5. 3 menus of **Stir fried**; Chicken with cashew nut, Pad Krapraw kai and Pad prig gang Moo
6. 3 menus of **Dessert**; sticker rice serve with ripe mango, Tab tim krob and Kang boud squash (reverse osmosis)
7. 2 menus of **Thai snack**; Peanut Crystal coating and Banana fritter
8. 4 menus of **Herbal beverage**; Amethyst drink, lemongrass drink, Thai ice tea and Emerald punch

**Part 3** The result of teaching implementation of the recipes had studied found that, the teaching cooking Thai foods with scientific explanation, known as “**Science behind Thai cuisine**” as the following;

3.1 The sample size was 237 students, 174 (73.4%) were females and 63 (26.6%) were male. Average age was 32.8 years old; 22 years old was the youngest and 51 years old was the oldest. Almost a half, 116 (48.9%) had experienced about cooking, more than one third of them 84 (35.4%) the family owned restaurant business.

**Table 1** Basic data of the sample n = 237

Items	amount	percentage
Gender		
females	174	73.4
male	63	26.6
Total	237	100.0
Had experienced about cooking	116	48.9
the family owned restaurant business	48	35.4
Average age was	32.8	years old
the youngest was	22	years old
the oldest was	51	years old

Most of them 229 (96.6%) satisfied the teaching method in much and very much level; they were interesting to learn how to cook Thai food with scientific explanation, because; they needed to again experience to cook Thai food in the right method, they want to be able to cook well for people, they were appreciated about Thai cuisine and they wanted to ran Thai food restaurant in future.

227 them (95.8%) had gained knowledge and understood cooking technique with scientific explanation, they have fun and enjoy the class, the teaching technique and methodology was not boring, the technique was easy to memorized recipes, they had learn about

sanitation and hygiene in the kitchen, using the right utensil for cooking was necessary, stock control of raw material and foods in the right way was important, they had more confidence to analyze the lessons that they would be able to solve such problems from cooking Thai foods by using scientific methods in future. They had gained confidence to cook in businesslike in future.

232 of them (97.9%) satisfied the teaching method in much and very much level, they understand and realize the planning and management in kitchen is important, they had learned the cooking technique between household cooking and cooking for businesslike, teaching with self-sufficient economy was important in restaurant business, teaching how to work fast and save was fun and they also agreed teaching to concern about save environment was necessary.

All of the students 237 (100%) believed that Thai eating culture, the promotion of "Thai Kitchen to the World" was one of important part of socioeconomic development in Thailand in much and very much level and they had suggested that the Thai government and private sectors needed to support such project to all.

### **Conclusion**

Thai foods had become well-known Globally, Thai foods' business had established more and more abroad, eating good Thai foods bring happiness and experiences, education and well train for cooking the right Thai foods and taste with the education transformation of knowledge and career is important for all was important, in order to conserve Thai eating culture. Teaching how to cook Thai foods with concept of "Science behind Thai Cuisine" had improved critical thinking ability for the students, they had learned and improved thinking process of critical expression, they have fun and enjoy the class, the teaching technique and methodology was not boring, they also learned teaching techniques to memorized the recipes a lot more easily, they had more confidence to analyze and believed from the lessons that they would be able to solve such problems from cooking Thai foods by using scientific methods in future. They had gained confidence to cook in businesslike in future.

### **Suggestion**

1. Research in order to promote Thai cuisine to be known as "Science and Art of High level cuisine" is important and necessary.
2. Thai foods contained with different kinds of herb and spice, which is good for healthy foods, and then the study to promote "Eating foods as medicine" is possible and interesting.
3. Thai government and stakeholders sectors needed to promote Thai cuisine as the World heritage of human culture and creation is necessary.
4. The amount of Thai restaurants abroad increasing all the time, many of them owned by the foreigners, therefore, providing how to cook Thai foods in the right way and right taste is necessary.

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