THE EFFECTS OF INQUIRY-BASED LEARNING PROGRAM ON CREATIVE THINKING OF CULINARY NUTRITION COLLEGE STUDENTS

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THE EFFECTS OF INQUIRY-BASED LEARNING PROGRAM ON CREATIVE THINKING OF CULINARY NUTRITION COLLEGE STUDENTS

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BY

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HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF EDUCATION IN M.ED. (EDUCATIONAL PSYCHOLOGY AND GUIDANCE) AT SRINAKHARINWIROT UNIVERSITY

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The purpose of this study were to develop inquiry-based learning program to enhance creative thinking of culinary nutrition students and to explore the effects of inquiry-based learning program on creative thinking of culinary nutrition college students. The study sampled 40 culinary nutrition students at Hezhou University, randomly divided into an experimental group and a control group, each with 20 students. The experimental group received an inquiry-based learning program, while the control group did not. The study was a quasi-experimental design with a quantitative data analysis. The research design of pre-test and post-test control group was used to examine the effects of inquiry-based learning program on creative thinking of culinary nutrition college students. The instruments used in this study were as follow: (1) The inquiry-based learning program to improve creative thinking of culinary nutrition college students (2) The Creative Thinking Test had a total reliability of 0.74 with difficulty index (P) was 0.49 -0.51 and discrimination index (D) was 0.38- 0.46. The data were analyzed by using descriptive statistics, mean, standard deviation, percentage, and t-test for dependent samples and independent samples. After the experiment, it was found that Creative Thinking of culinary nutrition college students in the experimental group was higher than the control group and before the experiment in three components with statistical significance at the .01 level.

Keyword : Inquiry-based learning, Creative thinking, Culinary nutrition, College students

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CHAPTER 1
INTRODUCTION

1.1 Background

The development of creative thinking has become a hot topic in education circles. Many researches abroad have emphasized the importance of creative thinking. In response to the debate on creative and cultural education, in western countries, the British government enhance learners' creative experience and provide creative thinking ability to meet the economic, technological, and social challenges of the 21st century (Loveless, 2002). The United States, Canada, and other countries regard creative thinking as students' learning goals, hoping that students can use creative thinking to develop unique products or generate some constructive and unique ideas, summarized as basic learning tasks (Shaheen, 2010). As in eastern countries. Singapore launched "Thinking Schools, Learning Nations" (TSLN) to enhance the creative thinking ability of the new generation of young people (Tan, 2006). In addition, especially in China, since 2001, China has prioritized the development of creative thinking skills and regards it as an important part of education (Vong, 2008).

Despite the continuous progress of China's education system, further efforts and improvements are still needed to eliminate "stereotypes" and "traditional education." Cultivating thinkers who can create freely and be original is difficult and schools stifle students' creativity. (Rogers, 1954; Alshannag & Hamdan, 2015). On the other hand, the current education in China emphasizes test-taking rather than learning creative thinking ability. Anderson (1993) proposed that China's education mode is a kind of irrigation education, and teachers are reluctant to use a new teaching method, so they do not have to take risks. Some Chinese teachers believe that linking learning with communication, exploration activities or entertainment can not be used as a learning tool, which will weaken students' learning attitudes and learning attention (Anderson, 1993). As a result, Chinese students are relatively weak in learning skills such as problem-solving and creative thinking. Therefore, China education today emphasized on cultivate students' creative thinking.

The importance and necessity of creative thinking lies in the fact that in the rapidly changing and uncertain future, cultivating creative thinking in education can help learners solve problems, cope with challenges, and improve competitiveness. Schools are also regarded as places to encourage creative thinking because students can be trained more systematically (Shaheen, 2010). Paul Torrance (2018) noted that creative thinking involves a mental process which can result in the creation of entirely new ideas or concepts, or the formation of new links between existing ones. Creative thinking is a natural process driven by pressing human needs (Torrance, 1972). According to Raviqah et al. (2023), the creative thinking process is dynamic between divergent and convergent thinking. Creative thinking is a unique way of thinking that brings fresh eyes to a problem or situation and dares to devise unconventional solutions that may initially seem strange. It is the act of putting imaginative new ideas into practice (Khuana et al., 2017).

In addition, Torrance (1972) emphasized that creative thinking is a skill that needs to be improved through practice. Chu et al. (2021) mentioned in their book that there are three main knowledge areas for skills in the 21st century, among which the first is the skills of creative thinking, which can adapt to the daily personal professional needs and social environment of the 21st century. Creative thinking skills include the cognitive ability to facilitate the generation and development of new ideas and provide fresh perspectives on previous ideas and innovative problem-solving methods. Learners with creative thinking skills have the potential to generate new ideas and they have characteristics such as flexibility, authenticity, and quantity. These characteristics help learners understand complex problems and promote fluency, flexibility, and novel problem-solving skills (Zarvianti & Sahida, 2020). It helps learners perceive the world in novel ways, explore hidden patterns, make connections between seemingly unrelated phenomena, and develop innovative solutions (Khuana et al., 2017). Therefore, fostering creative thinking is crucial because it helps people solve problems, build new businesses and organizations, innovate educational approaches, and lead creative lives and the results of creative thinking could be expressed through various creative

products (Torrance, 1972). Ravicah et al. (2023) also proposed that the output of creative thinking is the product of creativity and the external evidence of the creative thinking process. The products of creative thinking include apparent things such as music, poetry, dance, dramatic literature, stories, artwork, inventions, and technological innovations (Torrance, 1972; Khuana et al., 2017). In order to evaluate creative thinking, Paul Torrance (1972) collated data from his 133 studies and summarized the nine methods of cultivating creative thinking. Ultimately, his research results confirmed that creative thinking consists of four core dimensions: fluency, flexibility, originality, and elaboration, which can be used as criteria to assess the level of creative thinking.

From the research, we found that there were many methods to enhance creativity in classroom. In the field of education, one of the effective ways to enhance creativity was inquiry-based learning. Alshannag and Hamdan (2015), and Shao (2018) defined inquiry-based learning, arguing that inquiry-based learning is a deep teaching method that affects students' understanding and attitude towards science in a positive way. It can cultivate students' creative thinking ability in the classroom, and students change from passive receivers to active learners. Its teaching methods are exploration activities, questioning activities, or open questions. According to research from Fatmawati (2017) used 50 first-year students as experimental samples in his study, divided into control classes (24) and experimental classes (26). To measure students' creative thinking, this paper starts with inquiry-based learning and surveys the relevant question formation by referring to the fluency, flexibility, and originality of creative thinking. The results show that the inquiry-based teaching class has improved the three characteristics, which proves that inquiry-based learning can be used as a learning mode to cultivate creative thinking. In addition, in research of Purnawati et al. (2021) studied improving creative thinking among 49 students in grade 4 in Sleman Private Primary School. Two cycles of classroom research were adopted, and finally, observation and questionnaire were used to collect data. The results indicate that inquiry-based learning methods can enhance students' capacity for creative thinking.

At present, the research on inquiry-based learning is increasing day by day. Since 1999, inquiry-based learning in China's curriculum reform has been paid more and more attention. Inquiry-based learning is recognized as a teaching method that can promote creative thinking (Shao, 2018). In terms of instructional strategies, the learning pattern is student-centered, with teachers as guides and facilitators (Dewey, 1930; zhang, 2010). This teaching method emphasizes students' independent learning, actively encourages students to analyze and empirically explore the social and living environment and enables students to conclude their learning. In this way, students can develop creative problem-solving skills. However, traditional teaching methods only emphasize repetition and apply to some narrow areas, failing to develop students into independent thinkers who can learn effectively (Bransford, Brown & Cocking, 2000). Compared with traditional teaching methods, inquiry-based learning has many advantages. Sanita et al. (2021) analyzed data using activity observation tables and creative thinking test tools to pinpoint the various components of creative thinking abilities, including fluency, flexibility, originality, and elaboration. The results show that applying the inquiry-based learning method in teaching can significantly improve students' active participation and creative thinking ability. This finding strongly supports the effectiveness of inquiry-based learning for creative thinking.

Based on my practical teaching experience, the culinary operations course I teach is "Technics of dough modeling." The content of the course is characterized by technology, artistry, and science. For example, making a rose using special clay for dough sculpture, students should plan the rose's color and the petals' composition in advance. Splicing and the direction of petal spread, shape, and soft and hard surface mud will differ. Students need to learn the rules by observing or consulting relevant materials, so that they can make different products when making products.

But from my experience, students were expected to create specific culinary works, and the role of the teacher was often limited to guiding students to imitate according to a specific sample. This teaching method limits students' autonomy and inhibits their sense of creativity, resulting in a lack of diversity and creative in students'

works. Therefore, students of this course need to have creative inspiration and high insight, so creative thinking ability is essential for this major. As teachers need to stimulate learners to think independently, try new methods and creative imagination products. This way can help students break out of conventional thinking and improve their ability to solve problems or find new ways. Teachers should encourage students to think and learn to solve problems in class, thereby improving students' creative thinking.

As a teacher of culinary nutrition, I am very interesting to study the influence of inquiry-based learning on the creative thinking of college students majoring in culinary nutrition. My students are adolescence between the ages of 19 and 23. According to Piaget (1970), believed that adolescence develop the ability to abstract and solve problems, which enables them to consider ideas and concepts beyond concrete, direct experience and have the ability to solve problems. They are able to evaluate information for themselves, think critically, and make sound judgments by considering multiple perspectives (Ennis, 1989). According to Arnett (2000), believed adolescence like to explore and pay attention to independent thinking. Therefore, from the perspective of the thinking characteristics of adolescents, the adolescent stage is more suitable for this study.

In the study of inquiry-based learning and creative thinking, many studies that combine both aspects are focused on the field of education. However, most are for some specific disciplines such as English, mathematics. However, limited prior studies have been conducted on the creative thinking of students majoring in culinary nutrition who use inquiry-based learning. Therefore, the research of this paper is very necessary to carry out, which is also a creative point of this research.

The significance of this study lies in cultivating learners' creative thinking and improving their learning skills through inquiry-based learning. By helping learners manage their learning process more effectively and also encourages the idea of lifelong learning. Learners are encouraged to actively participate in the learning process, to think deeply about problems, and to find innovative solutions. At the same time, being able to improve their academic achievement also provides a strong foundation for

students to succeed in their future careers and in life. They may further become artisans of culinary and become innovative food creators, bringing new inspiration and creativity to the field of gastronomy.

1.2 Objectives of the Study

The research conducted for the purpose as follow:

1. To develop Inquiry-based learning program to enhance creative thinking of culinary nutrition students.

2. To study the effect of Inquiry-based learning program

2.1 Compare the difference in creative thinking level between the control group and experimental group after attending inquiry-based learning program.

2.2 Compare the difference creative thinking level between experimental group before and after attending inquiry-based learning program.

1.3 Significance the Study

Based on the theoretical foundation of this research, an Inquiry-Based Learning Program (IBLP) was designed to promote the development of creative thinking in university students from theory to practice. This program is better aligned with the cognitive levels of students majoring in culinary nutrition and is more readily accepted by them.

For students, this study provides a clear pathway for fostering creative thinking through the design of a program aimed at enhancing their creative thinking ability. This not only improves the understanding of creative thinking development at this stage but also identifies and supports students who are lacking in creative thinking, thereby effectively promoting the development of creative thinking in university students.

For teachers, the Inquiry-Based Learning Program (IBLP) offers empirical research support for the education of culinary nutrition students, refines the creative thinking strategies within intervention programs, and provides new strategic support for professional growth.

1.4 Scope of the Study

1. Population

This study primarily focused on 160 students from the first to the third year majoring in Culinary Nutrition at Hezhou College.

2. Sample

The research objects of this study are college students majoring in culinary nutrition. Firstly, 160 students were given a creative thinking test to examine creative thinking. The samples of this study were 40 students who were chosen by purposive sampling and had mean score of creative thinking form the 25 percentiles down. They were randomized to the experimental group and the control group equally (20 students in each group). The experimental group was provided by inquiry-based learning program, while the control group was not. In order to ensure the reliability of the research results, there are no differences in age, academic performance, and age between the two groups of students.

3. Variable:

There are two variables in the study.

The independent variable is inquiry-based learning program.

The dependent variable is creative thinking.

1.5 Definition of terms

1. Creative thinking refers to as the mental process by which an individual first perceives gaps, missing, or troubling elements, then produces new ideas or hypotheses related to them, then tests these hypotheses, and eventually transmits the results of the verification, possibly revising and retesting the hypotheses as needed (Paul Torrance, 1962). Creative thinking in this study comprise of three components as follows:

Fluency: refers to ability to produce many fluency ideas within a certain time.

Originality: refers to ability to develop some unusual and novel ideas.

Elaboration: refers to ability to explore in depth and bring more engagement and knowledge enrichment by building a more detailed description of its basic concepts.

2. Inquiry-based learning refers to an education method that emphasizes exploration and solving problems, learning-independent teaching method that can cultivate students' higher-order thinking ability, critical and creative thinking and emphasize active participation (zhang, 2010; Australian Government Department of Education, 2023).

The implementation of inquiry-based learning program consists of five stages: Engagement, Exploration, Explanation, Elaboration, and Evaluation.

Step1 Engagement: Before the beginning of the course, teachers raise questions or situations to stimulate students' previous knowledge and guide learners to develop in the right cognitive direction to ensure students' attention and increase their interest in knowledge inquiry to promote the acquisition of new knowledge.

Step2 Exploration: Before the beginning of the course, students conduct exploratory activities based on existing knowledge, learn new knowledge, and construct new concepts. Teachers act as facilitators and form a learning community with students.

Step3 Explanation: In the class, students share their gains in the exploration stage, and teachers guide, or professors promote students' understanding of new knowledge and concepts, summarizing and explaining in time to promote efficient learning and strengthen students' knowledge construction.

Step4 Elaboration: At this stage, students can get their understanding through practical activities, better master the skills and behaviors learned in practice, and have a deep understanding of the problems encountered.

Step5 Evaluation: Through multi-party evaluation, students and teachers and students carry out real feedback learning, help students to inspire new ideas, and solve doubts. It also improves teaching methods and students' mastery of learning objectives.

1.6 Conceptual Framework of the Study

This study primarily aims to investigate the impact of an inquiry-based learning program on the creative thinking of students majoring in culinary nutrition. The figure below depicts the study's conceptual framework and identifies the relationship between inquiry-based learning program and creative thinking.

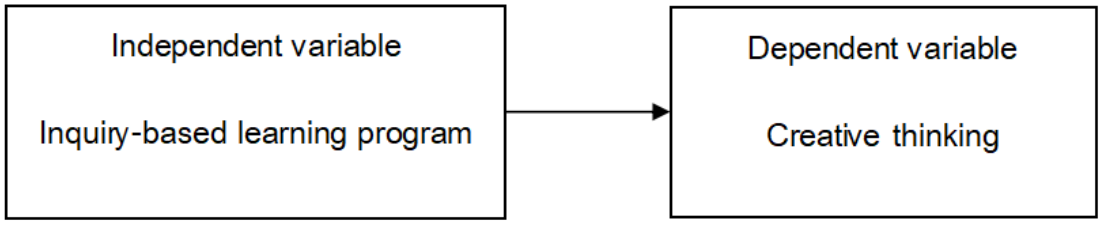

Figure 1 Conceptual Framework: Independent and dependent variable

1.7 Research Hypothesis

For the purpose of the study, the following assumptions were used:

1.7.1 After participating in inquiry-based learning program, the experimental group has a higher level of creative thinking than before.

1.7.2 After participating in inquiry-based learning program, the experimental group had a higher level of creative thinking than the control group.

CHAPTER 2
REVIEW OF THE LITERATURE

This chapter is a review of the available literature dealing specifically with:

2.1 Creative Thinking

2.1.1 Definition of Creative Thinking

The father of creativity, Paul Torrance (1962), defined initially *creative thinking as* the process by which an individual first perceives gaps, missing, or troubling elements, then produces ideas or hypotheses related to them, then tests these hypotheses, and eventually transmits the results of the verification, possibly revising and retesting the hypotheses as needed. Since then, Paul Torrance (2018) noted that creative thinking involves a mental process which can result in the creation of entirely new ideas or concepts, or the formation of new links between existing ones.

Guilford (1950) identified the concept of divergent thinking as a key aspect of creative thinking. He believes that creative thinking is the ability to solve problems and to think of various ideas to deal with open-ended problems.

Pioneer in the field of creative thinking- Edward de Bono. He introduced the concept of "lateral thinking": solving problems from a particular perspective. In his book Lateral Thinking, De Bono's definition of creative thinking describes a break with conventional linear thinking processes. It encourages the exploration of unconventional and innovative ideas through structured techniques. In his view, creative thinking is a practical approach to solving problems and generating new, meaningful, and valuable solutions (Bono, 1970).

According to Teresa M. Amabile (1983), creative thinking is a cognitive activity that is dynamic, context-dependent, and capable of helping people living and working in various fields solve problems and innovate.

In an educational context, creative thinking is considered as creativity (Webster, 1990).

Robert Sternberg (2003), a psychologist known for his research on intelligence and creativity, proposed a three-fold theory of intelligence that includes a component known as "creative ability." He says creative thinking is "the ability to generate new and valuable ideas."

Fatmawati (2017) thinks, Creative thinking is a mental disposition cultivated through attentive intuition, stimulating imagination, uncovering novel possibilities, unveiling remarkable perspectives, and generating unforeseen ideas.

The perspectives of these researchers reflect the evolution and diversity of creative thinking. Many scholars assert that creative thinking involves problem-solving using original and distinctive approaches. Individuals adept at creative thinking can transcend conventional thought patterns, considering diverse solutions from multiple perspectives and embracing unconventional methods.

2.1.2 Importance of Creative Thinking

Trilling and Fadel (2009) pointed out that education is the key to economic survival in the 21st century. They believe that three skills must be mastered in the 21st century: “Learning and innovation skills; Information, media, and technology skills; Life and career skill" (Trilling & Fadel, 2009, p. 48). These three skills will be at the core of what a self-reliant lifelong learner needs. According to the researchers, in the 21st century, the ability to answer questions is not the standard by which students’ correctness for the answer are judged but the degree to which they apply the skills and knowledge they possess. These skills can be developed through problem-solving, critical thinking, and Creative thinking. Lsaksen et al. (2010) believe that creative thinking is a tool that can solve complex problems and improve the ability to solve problems.

Because of broad social and economic trends, Sawyer (2011, p. 3) makes several summaries of the importance of creative thinking:

“1. As markets become increasingly global, competition intensifies, even for industries that have traditionally been shielded from major disruptions.”

“2. The ongoing enhancement of sophisticated information and communication technologies shortens product development cycles.”

“3. Positions that do not demand creativity are increasingly being automated or relocated to very low-wage countries (Figure 2).”

“4. Growing wealth and leisure time in developed countries (and elsewhere) have boosted the demand for products from the creative industries.”

From Sawyer's observation of the future of work in the 21st century in Figure 2, it can be seen that in many developing countries, daily work is mainly dependent on human labor, but machines also do some work. In the developed world, by contrast, work places more emphasis on creative needs.

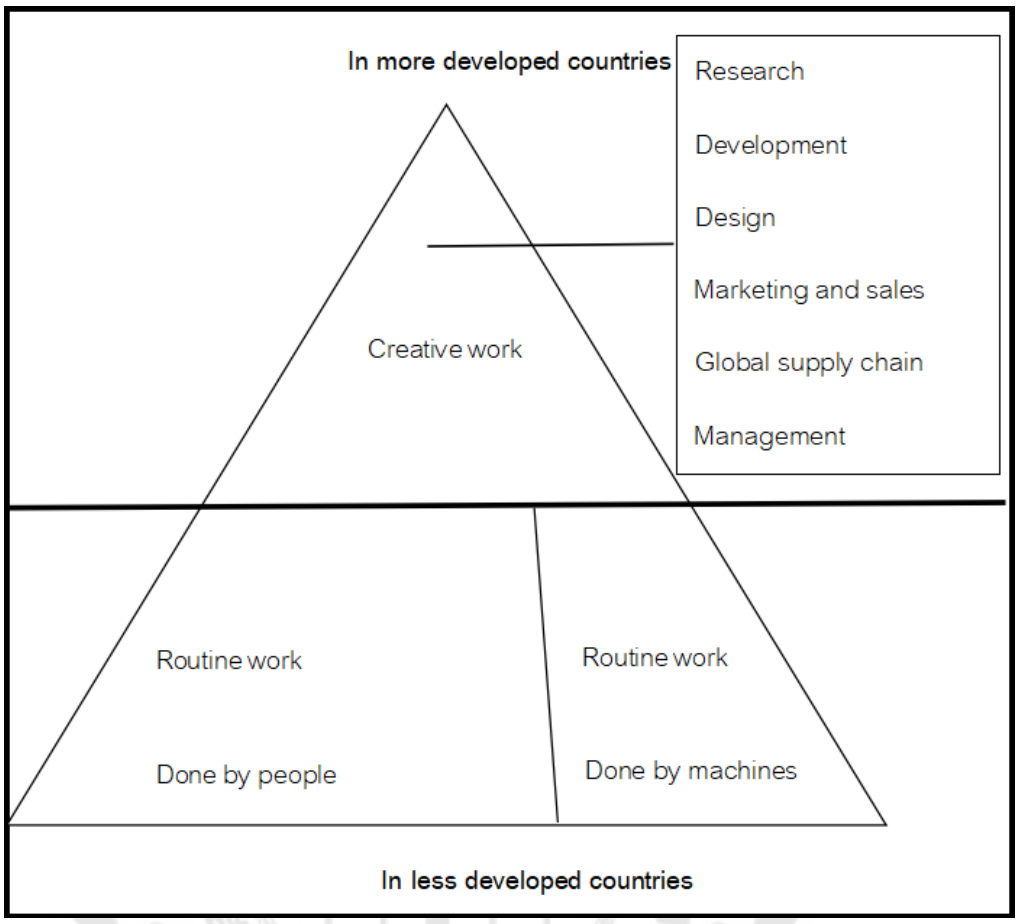

Figure 2 The Future of 21st Century Work

Source: Adapted from National Center on Education and the Economy, 2007.

Creative thinking can change people's lives with new ideas and promote them in various fields, especially new products and ideas (Christensen, 2013). In Schumpeter's (2013) book, he proposed the concept of "Creative Destruction." He believed that innovation was the main driving force of economic development and emphasized the role of promoting innovation and economy.

Creative thinking is one of the skills of the 21st century and has become a basic human need. It can help students find more ideas in different perceptions, concepts, and general knowledge. Developing creative thinking skills may also improve students' other thinking skills (Anjarwati, Sajidan & Prayitno, 2018).

From the views of the above researchers, creative thinking has an important impact on education, the economy, and other aspects. Creative thinking is already a necessary skill for future development.

Therefore, cultivating creative thinking skills is very important to improve many skills of students, which can make them more adapted to life in the 21st century.

2.1.3 The Components of Creative Thinking

Torrance (1962, 1969, and 1972) and Guilford (1967) theorize that there are four main elements of creative thinking: fluency (idea generation), flexibility (different idea generation), originality (different idea derivation), and elaboration (mastery of detail).

Fluency refers to the ability of individuals to generate multiple novel ideas quickly and continuously when faced with a challenge.

Flexibility refers to the ability of individuals to show a variety of thinking paths and produce a variety of different methods and uses when solving problems or facing challenges.

Originality refers to the ability of an individual to think differently and produce ideas and solutions that are unprecedented.

Elaboration refers to individuals' ability to deepen and enrich basic ideas, and make creative ideas more fascinating through carefully woven stories and precise control.

Wallach (1968), in his review of Torrance's creative thinking test, talks about Torrance's creative thinking-related test procedures, which mainly involve the use of verbal and other graphic materials. First, it is worth considering the language test. The question-and-guess test asks respondents to look at a picture of a clown and list all the possible problems with the image, the situational reasons for the image, and the possible consequences that could lead to the depicted situation. Similarly, other tests such as the "product improvement" test, the "unusual use" test, the "unusual question" test, and the "what-if" test all involve asking questions that focus on unusual or intellectual thinking. At the same time, there were three graph tasks, including the image

construction test, the incomplete graph test, and the parallel line test, which required participants to respond to graph-related questions uniquely. The tests were scored on four criteria:

- fluency (The number of relevant responses provided)
- flexibility (The number of categories of meaning spontaneously switched from one to another)
- originality (The relative unusualness of the responses provided)
- elaboration (The degree of specificity and detail of the responses provided)

These four scoring criteria form the components of creative thinking.

Treffinger et al. (2002) believe that creative thinking includes five components:

Fluency: Be able to put forward some ideas and suggestions quickly and smoothly within a certain time or prescribed time.

Flexibility: the ability to generate different ideas, questions, or answers from different perspectives by changing the way of thinking.

Originality: refers to something unique that was not proposed or could not be imagined by others.

Elaboration: The ability to elaborate an object, idea, product, or situation in rich detail to make it more interesting.

Metaphorical thinking: To find connections between specific images of known things and new things or experiences through analogy and association.

From the common point of view of scholars' research, innovative thinking mainly consists of four parts: fluency, flexibility, originality, and elaboration.

2.1.4 Characteristic of a person with a creative mind

In Torrance's (1962) study, he conducted a creativity study of 23 classes of male and female students in two Minnesota elementary schools, covering grades one through six, by having the students take the "draw a house-tree-person" test. Intelligence tests were also administered, with one school using the Stanford- Binet Intelligence Test

and the other using the California Intelligence Maturity Test to assess students' intelligence.

Through a comparative and blind analysis of the student's test results, the study developed three personality traits between highly creative and low creative but equally intelligent students. First, highly creative students, especially male students, are known for their creative but unusual ways of thinking. Secondly, students' works with high creativity have unique characteristics different from the conventional ones, which are non-adherence to traditional rules and innovation. The study found that highly creative students performed relatively poorly on intelligence tests, compared to less creative but equally intelligent students, because the former's way of thinking did not conform to the standardized dimension, the behavioral norms for assessing responses. Third, the work of these creative students usually has a sense of humor and playfulness and is relatively free from stereotyping and tension.

The findings highlight specific aspects of creative thinking, including boldness and non-conventionality, as well as humor and originality in writing, which are particularly strong among boys. These results provide important insights into the development of creative thinking.

Getzels & Jackson (1962) pointed out that traditional intelligence tests could not fully assess individual potential, so other forms of intelligence must be sought. The identification of creativity has aroused a wide range of interest. Usually, it covers creative qualities that are original and dynamic. Getzels & Jackson (1962) focused their research on students at two private schools, covering a sample from sixth grade through high school. Of about 450 students, 28 were in the top 20 percent on intelligence tests but did not reach the same level on creativity tests. The researchers compared this group of students with 26 students in the "high creativity" group, who performed the opposite on the creativity test. The significant differences between the two groups can be summarized as follows: "The highly creative students exhibited more expand material and fantastical endings in the test stories and pictures, displayed a more playful attitude toward the suggested topics, and displayed more humor and creativity." In general,

highly creative students are less rigid about traditional rules. Among students with higher creative tendencies, fathers are likelier to work in business and teach their children less. The students' mothers did not emphasize good behavior, and in lengthy interviews, they rarely mentioned their children's bad qualities. The atmosphere in these homes is more relaxed.

Guilford (1967, p. 7) argues that highly creative people tend to have a strong interest in aesthetic and theoretical issues and that they tend to be highly intuitive and introverted. In terms of intelligence, most people are on the high end of the IQ spectrum, but within this range, there is little correlation between IQ and levels of creative performance. At the same time, Guilford (1967) believes that people with creative thinking have divergent thinking, and he mentions that creative thinking often involves divergent thinking, that is, producing many different lines of thought and possibilities. Creative thinkers show superior ability in problem solving. They are able to identify complex problems and come up with innovative solutions.

Csikszentmihalyi (1997) believes that in the process of individual creativity development, multiple factors interact and jointly shape their creative ability. According to Csikszentmihalyi (1997), creative people exhibit a series of multidimensional traits that are intertwined to make up their unique personality and creativity, which are summarized in the following characteristics.

Highly adaptable: Creative individuals are highly adaptable, able to respond well in a variety of situations and take the necessary steps to achieve their goals. This adaptability makes them stand out. At the same time, creative people display a light-hearted attitude, but they also possess perseverance and perseverance. They are able to persevere, overcome all kinds of inevitable difficulties, and make the enormous effort required to turn original ideas into reality.

Able to blend convergent and divergent thinking: There are two very different ways of thinking. One is convergent thinking, which is used to solve clearly defined problems to which there is only one right answer. The other is divergent thinking, which is able to generate a large number of ideas, switch different points of

view, and make creative mental connections. Creative people have the ability to use these two opposing ways of thinking flexibly.

Domain advantage and internalization domain: The first is the influence of genetic factors; that is, an individual's nervous system may have a difference in sensitivity to a particular domain, which can bring an advantage in that domain. Secondly, early interest is also a key factor, as some people may have a strong interest in the field because of their early-perceived advantages. Access to the field is equally important, and while lucky factors such as being born into a wealthy family or being close to quality educational resources may provide certain advantages, many creative people also show great perseverance and determination to overcome obstacles and enter their field of interest. Finally, creative individuals need to deeply understand and internalize a field or culture while believing in its importance, which means they need to have a traditionalist and conservative attitude but also the ability to rebel and disrupt tradition. Only in this balance can the field continue to evolve while avoiding unnecessary risks.

Strong social skills: In a certain field, recognition and effective communication skills are equally important. Even if a person has extensive knowledge, failure to connect and communicate with key people in the field can lead to neglect or isolation early in their career. Therefore, creative people need to be recognized and appreciated by their peers. Otherwise, it is difficult for them to achieve achievements that are considered innovative. Without this recognition, they may not have access to the latest information, missed job opportunities, and may be ignored or ridiculed even if they successfully complete innovative work.

Complex personality: Creative individuals do not have a fixed set of traits. What makes them different is that they have complex and diverse personalities, capable of simultaneously displaying tendencies in thinking and behavior that are normally separate in most people. This complexity means that they are able to fully demonstrate the full range of potential human traits, without being limited by the idea that we often

think of one extreme as "good" and the other as "bad." They can move flexibly from one extreme to the other, depending on the needs of different situations.

Psychological gender diversity: Creative people usually exhibit a variety of characteristics of psychological gender and can present more rich and diverse characteristics. They not only possess the characteristics of their own sex but also the qualities associated with the opposite sex. For example, creative women are generally more dominant and resilient than other women, while creative men are relatively more sensitive and less aggressive. In addition, female artists and scientists tend to be more confident and self-assured than the typical woman, displaying a more pronounced autonomy. At the same time, the creative male also exhibits qualities that differ from traditional masculine traits through his care for his family and sensitivity to subtle aspects of his environment.

Have good physical fitness and plenty of energy: Creative people usually have a lot of physical strength, can sustain a high concentration of work for a long time, and radiate a new and enthusiastic atmosphere in their work. However, this energy is more due to their focused thinking than simply due to genetic excellence.

Be passionate and objective: Creative people are often passionate about their work while also being extremely objective. Passion is essential to maintain interest in complex tasks, but objectivity is also necessary to ensure that the work is credible and can be recognized.

High intelligence and naive: Generative individuals are often highly intelligent but can also appear naive. Too low an IQ may affect creativity, while too high an IQ may also adversely affect creativity. Those with high IQs can slip into complacency and lose the curiosity that is essential for creative. If it becomes too easy for those with higher IQs to learn facts and understand the rules of existing fields, there may be less incentive to question, doubt, and improve existing knowledge.

The alternation of imagination and reality: the creative individual has the ability to flexibly switch between imagination, fantasy and reality. They have the ability to transcend reality but at the same time maintain a connection to the past.

Self-awareness and humility: Creative individuals have a clear sense of self, they understand the contributions of previous scholars, and they understand the role of luck in shaping their own achievements. Although they usually focus on future projects and current challenges, they still recognize past achievements. When compared to others, they know that they have achieved a lot and, therefore, project a sense of confidence and security.

Ambitious: Creative people are ambitious and are willing to put personal comfort and personal development above the success of a project.

Openness and sensitivity: The openness and sensitivity of creative individuals enable them to experience both pain and pleasure. Their heightened sensitivity may lead them to perceive anxieties and inequalities that others do not easily perceive. One of the most important qualities of creative people may be their ability to enjoy the process of creating for its own sake, which is why they are willing to forgo more lucrative career opportunities in order to focus on what they are passionate about. In addition, creative individuals may have both extroverted and introverted traits.

It is worth noting that Amabile's (2018) research emphasizes the interaction between individual characteristics and the environment in which creativity is generated. Her research provides a comprehensive perspective, taking into account the following characteristics:

Expertise: Creative thinking often requires a solid foundation of knowledge and expertise in a particular field. Creative people may have a deep understanding of their field, which allows them to explore new possibilities and make new connections in that field.

Flexibility: Creative thinkers are usually flexible in their thinking. They are able to adapt to new situations, think from multiple perspectives, and solve problems from multiple perspectives.

Open to experience: Creative people tend to be open to new experiences and ideas. They are curious and willing to explore unfamiliar territory, which may lead to new insights.

Persistence: Amabile (2018) acknowledges the importance of persistence in creative endeavors. Creative people are willing to invest time and energy in their creative projects, even in the face of setbacks and challenges.

Taking risks: Creativity may involve taking risks, trying new approaches, and challenging traditional norms. Creative people are often willing to take these risks.

Emotional sensitivity: Amabile (2018) suggests that creative people may be more emotionally sensitive or sensitive to their own emotions and those of others. This sensitivity can affect their creative work and expression.

In summary, individuals with creative minds tend to exhibit multi-dimensional traits, including adaptability, multi-thinking, domain strengths, social skills, complex personalities, multi-gender traits, high physical strength, passion and objectivity, high intelligence and curiosity, imagination and realism in harmony, self-awareness and modesty, ambition and determination, openness and sensitivity. These qualities are intertwined, and they constitute the unique characteristics of creative individuals. They are essential for developing one's innovation and creativity. In addition, individual expertise, flexibility, open experience, perseverance, risk-taking, and emotional sensitivity are also closely related to creative thinking. People with creative thinking are better able to solve problems and find different solutions.

2.1.5 Factors affecting creative thinking development

Amabile (1983) divides the factors that may affect creative thinking into three components: Domain-relevant skills, Creativity -relevant skills, and Task motivation.

Domain-relevant skills: Amabile (1983) believes that domain-relevant skills may influence a person's creative thinking. For example, one's familiarity with the problem area and factual knowledge: facts, principles, views on various problems in the field, and the capability of solving problems in related fields. It also includes technical skills may be needed in specific areas, such as techniques for laboratory operations or other techniques that may contribute to creative thinking. Moreover, Amabile (1983) proposed that the influence of this part depends on the individual's innate cognitive,

perceptual, and motor abilities, as well as the different forms of education (formal and informal) received in the relevant fields.

Table 1 Domain-relevant skills

	Includes	Depends on
Domain-relevant skills	Knowledge about the domain	Innate cognitive abilities
	Technical skills required	Innate perceptual and motor skills
	Special domain-relevant “talent”	Formal and informal education

Creativity- relevant skills: Webster (1990) said that creativity is creative thinking, and having creative skills is conducive to the derivative of creative thinking. Amabile (1983) pointed out in her research that creativity skills include a cognitive style, which refers to breaking the set to solve problems in complex situations. It also includes heuristic knowledge that leads to new ideas. Amabile (1983) as a skill that is most likely to break new ideas considers heuristic knowledge. In addition, whether a person has the skills related to creativity also depends on whether he or she has been trained. Training is an organized and purposeful experience that can teach some ideas to improve creativity skills.

Table 2 Creativity- relevant skills

	Includes	Depends on
Creativity-relevant skills	Appropriate cognitive style	Training
	Implicit or explicit	Experience in idea generation
	Knowledge of heuristics for generating novel ideas	Personality characteristics
	Conducive work style	

Task motivation: Amabile (1983) proposed that a person's internal motivation would be affected by external constraints, resulting in damage and a decline in creative expression. According to the definition of motivation by Green (2002), motivation can inspire, encourage, lead, and direct learners' behavioral willingness and learning attitude and it is an internal state that guides and maintains behaviors. Creativity will be strong if the main motivation for doing an activity is internal; otherwise, it will decline. In this context, task motivation can be seen as the most important determinant of the difference between what a people can do and what he or she will do.

Table 3 Task motivation

	Includes	Depends on
Task motivation	Attitudes toward the task	Initial level of intrinsic motivation toward the task
	Perceptions of own motivation for undertaking the task	Presence or absence of salient extrinsic constraints in the social environment
		Individual ability to cognitively minimize extrinsic constraints

In the framework produced by Amabile (1983), these three components explain the phenomenon of relatively mature creativity, the importance of differences in human talent, cognitive skills and education, and individual innate interests and personality traits. These factors are necessary to produce creative thinking and influence the development of creative thinking.

Sternberg & lubart (2003) believe that a person's creative thinking is influenced by his knowledge level, way of thinking, personality characteristics, motivation, and personal working environment background.

From the perspective of scholars, the shaping of creative thinking is influenced by three main factors: domain-related skills, creativity-related skills, and task motivation. In addition, an individual's knowledge level, way of thinking, personality

characteristics, motivation level, and working environment background also play a crucial role in shaping and influencing the process of creative thinking.

2.1.6 Measurement of creative thinking

Lin et al. (2003, p. 152), in his research, summarized several well-known tests of creative thinking:

(1) The creativity test compiled by Gilford and his colleagues includes five verbal and five graphic tests in 10 sub-tests. The norm group consists of grade 4 and Grade 6 students.

(2) Torrance Creative Thinking Test divided into speech, picture, listening and speaking three sets, suitable for children to graduate students.

(3) The creativity test prepared by Geisels and PW Jackson at the University of Chicago, this test is suitable for teenagers from primary school to high school, suitable for group testing, and has a time limit.

(4) Test of creative thinking published by Waseda University, Japan.

Lin et al. (2003) believed that creative thinking is generally a test to measure creativity. With divergent thinking as the index, there are two kinds of topics: language and painting. From the fluency of thinking, flexibility, originality, refinement and other aspects of evaluation.

Amabile (2018) states that creativity tests commonly used in empirical research can be divided into three categories: personality tests, biographical inventories, and behavioral assessments.

The first category of personality tests includes traditional personality scales, from which "creativity scales" have been developed. For example, the 16 Personality Factors Questionnaire (16PF) by Cattel & Mead (2008), it is a widely used self-reported assessment tool designed to measure various personality traits. The main goal of the 16PF is to provide a comprehensive and in-depth assessment of an individual's personality by examining 16 major personality factors or dimensions. These factors include various personality traits that provide a detailed and nuanced understanding of a person's psychological makeup. The 16PF questionnaire effectively provide

comprehensive and objective information. It is widely used in various settings, including consulting, basic research, and educational settings (Cattel & Mead, 2008).

Biographical inventory. A second approach to assessing creative personality is the management of biographical inventories. These lists were initially crafted with an intuitive approach and then honed through testing participants who demonstrated either high, low, or average levels of creativity (Amabile, 2018). Take, for example, the Alpha Biographical Inventory, a survey of 300 items in areas such as family life and developmental history, academic background, adult life and interests. ABI is designed specifically for high school juniors and seniors, and it predicts both creativity and academic success in college (Davis & Belcher, 1971).

Behavioral testing. Amabile (2018, p. 24) argues that this assessment is more like a test than a personality or biographical checklist. This series of behavioral assessments includes tests that resemble traditional intelligence tests in terms of administration and structure.

The Torrance Creative Thinking Test (TTCT) is recognized as the most commonly used testing method and serves as the benchmark for many other creativity assessments. The scoring of the TTCT test is based on four key aspects of creativity, largely derived from Guilford's theory.

1.Fluency, which generates a lot of ideas

2.Flexibility, involving a range of creative ideas

3.Elaboration, extension, growth, enrichment, and fleshing out ideas.

4.Originality, which involves using ideas that are neither obvious nor commonplace and are not frequently observed

There are three types of TTCT tests: non-verbal tests (TTCT-Figural), verbal tests using non-verbal stimuli (TTCT-Verbal), and verbal tests using verbal stimuli (TTCT-Verbal).

TTCT-F consists of three image-based activities: building the picture, completing the picture, and repeatedly drawing a line or circle. Each activity takes 10 minutes. These activities assess the brain's ability to think creatively, covering areas

such as fluency, originality, and elaboration (Torrance, 1966). An example of a non-verbal test is the "circle task," in which participants generate as many distinct objects as they can using the same blank circle and assign a title to each drawing. Fluency is assessed based on the overall quantity of circles utilized. Flexibility is assessed by the range of "different categories" of objects represented. Originality is assessed by awarding each response either 1 point (if it is used by less than 5% of the general population) or 2 points (if it is used by less than 2% of the population). Finally, refined evaluations are scored based on the amount of "relevant detail" used in the sketch (Amabile, 2018).

The "product improvement" test is another verbal assessment that employs non-verbal stimuli. During the test, children watch a toy dog and are prompted to "discover the most clever, humorous, and unconventional methods to enhance the toy dog for more enjoyable interactions between boys and girls." A verbal assessment that incorporates verbal stimuli is exemplified by the "consequences" test. In this test, subjects must answer questions such as "What would happen if people were free to become invisible?" at a set time.

Torrance Creative Thinking Test (TTCT) asks subjects to respond orally, in writing, or drawing; these answers can be scored separately for different categories. However, sometimes these scores are combined into an individual's creativity score. The test administration follows a standard set of procedures, usually organized by the subject's teacher, and is subject to strict time limits. The instructions for the exam make it clear that good answers are those that are original and intelligent.

This study takes college students majoring in culinary as the research object, focusing on the visual presentation of the works. After comprehensively considering the above scholars' viewpoints, Torrance Creative Thinking Test (TTCT) is a more appropriate measurement tool for this study. It will also focus on using images for creative thinking tests, without language tests involving non-verbal stimuli or language tests using verbal stimuli.

2.2 Inquiry-Based Learning

2.2.1 Definition of Inquiry-Based Learning

Believing that all true education arises from experience does not imply that every experience is genuinely or equally educational. Experience and education are not directly interchangeable (Dewey, 1938). Dewey is the first scholar to propose inquiry-based learning. He believes that the experience of students and the actual participation are the most important in teaching, and the process and method of scientific research should be paid attention to in learning. His view laid the foundation for this approach and thus promoted the development and practice of this teaching method. On this basis, Joseph Schwab, a famous American scientist, curriculum theorist, and educator, actively advocated teaching and learning with an inquiring attitude in educational work (Schwab, 1969). As Dewey's ideas on science education influenced Schwab, his views, like Dewey's, also proposed that students should participate in teaching, rather than sit in a classroom and receive scripted education (Schwab, 1958). Both scholars emphasize the importance of experience in learning and believe that students should explore problems through actual participation, develop their thinking in the learning process, and build their knowledge system to explain and deepen their understanding of knowledge.

In the view of many scholars, inquiry-based learning is carried out under the theory of constructivism. Bruner (1960) emphasized the importance of active learning and problem finding. He believes that students should actively participate in building their knowledge. Seymour Papert (2020) is a pioneer in educational technology and constructivism who promotes learning through active engagement and using technology as a tool for exploration. He believed that students should learn by creating and designing. Pink's (2011) research on learning motivation and autonomy is connected to inquiry-based learning. He stresses the importance of intrinsic motivation and autonomy. Laksana (2017) believes that, from a constructivist perspective, this learning approach can help students understand a concept. Handayani et al. (2018) argue that inquiry learning is more than just a straightforward learning method; it is also a philosophical

approach to both learning and teaching. This approach is based on research and constructivist methods, allowing students to participate actively.

It is also important to note that some scholars consider inquiry-based learning as a teaching approach that merges students' curiosity with scientific methods, fostering the development of students' higher-order thinking ability while learning science (Warner & Myers, 2009; Tindangen, 2018). This approach enables children to learn about real life in science and scientific knowledge in real life (Zion & Slezak, 2005).

Inquiry-based learning does not teach students thinking skills from the beginning but is a teaching method that uses problems to drive students' thinking growth and learning process (Ghaemi & Mirsaeed, 2017).

Inquiry-based learning is an instructional approach centered around students, aimed at promoting active learning, cultivating students' higher-order thinking skills, and emphasizing their active participation (Kolb, 2014; Archer-Kuhn, Wiedeman & Chalifoux, 2020; zhang, 2010).

Based on the definitions of previous scholars, it can be summarized as a student-centered constructivist teaching method that combines theory and practice. This method mainly cultivates students' advanced thinking and independent learning ability. Students need to participate in the learning process actively, learn to find problems, think deeply, and build their knowledge in the inquiry process.

2.2.2 Characteristics of Inquiry-based Learning

Dewey (1930) argued that inquiry-based teaching is student-centered. The teaching of this method focuses on the learning process of students. It emphasizes active, experiential learning, encouraging students to personally explore and raise questions about their experience and learn to construct their understanding through their knowledge. Bruner (1990) argued that students should learn to create knowledge and construct their understanding of knowledge rather than imposing it through direct teaching by teachers. According to Kember (1997), students are independent individuals, not audience members, passively absorbing teachers' knowledge. The

teacher's role should be as a facilitator to help students learn. The result of the teaching process understands, and students should be actively involved in the learning process.

Kah & O'Rourk (2005) outlined the features of inquiry-based learning in five key points:

1. Engaging with intricate problems or scenarios that offer enough flexibility to accommodate various responses or solutions.

2. Students take charge of the inquiry process and the methods utilized.

3. The inquiry demands that students utilize their existing knowledge and recognize areas for further learning.

4. Tasks spark curiosity in students, motivating them to actively explore and search for new evidence.

5. The student takes on the responsibility of analyzing and presenting evidence in suitable manners to support their own approach to the problem.

The primary purpose of inquiry-based learning is to create an attractive and positive learning environment (Friesen & Scott, 2013).

Asy'ari et al. (2021) believe that inquiry-based learning has three main characteristics:

It is a kind of activity that students domain the learning, which students should exert their maximum ability to explore, seek, and discover.

The purpose of learners' participation in activities is to get their answers and solutions to the questions raised, from which students gain self-satisfaction and self-efficacy, thereby cultivating their' self-confidence.

This approach mainly develops learners' ability to think systematically, estimate logic and critical thinking, and can develop intelligence, which is a mental process.

Inquiry-based learning starts with stimulating students' thirst for knowledge and curiosity and putting forward exploratory open-ended questions for students to participate in the investigation, active learning, and problem solving. Teachers should learn to let students set goals, have ownership of learning, develop the ability to learn

independently, and let students take more responsibility for their learning. Under this method, students are the protagonists of the classroom and student-centered and student-active learning are the main characteristics of this method.

2.2.3 Benefits of Inquiry-based learning

Researchers believe that inquiry-based learning is a scientific method that can support deep learning, provided the teaching design is reasonable (Bradford, Brown & Cocking, 2000; Barron & Harling-Hammond, 2008; Sawyer, 2006). The traditional teaching methods, which only emphasize repetition and eventually apply to some narrow areas, fail to develop students into independent thinkers who can learn effectively (Bransford, Brown & Cocking, 2000). When employed as a teaching tool, inquiry-based learning (IBL) involves a process of discovery and systematically advancing to more profound and comprehensive levels of understanding (Archer-Kuhn, Wiedeman & Chalifoux, 2020).

Sawyer (2005) pointed out six teaching methods to promote deep learning and compared them with traditional ones. He believed students' experience and active participation in inquiry-based learning was a deep learning method.

Learning Knowledge Deeply (Findings from Cognitive Science)	Traditional Classroom Practices (Instructionism)
Deep learning requires that learners relate new ideas and concepts to previous knowledge and experience.	Learners treat course material as unrelated to what they already know.
Deep learning requires that learners integrate their knowledge into interrelated conceptual systems.	Learners treat course material as disconnected bits of knowledge.
Deep learning requires that learners look for patterns and underlying principles.	Learners memorize facts and carry out procedures without understanding how or why.
Deep learning requires that learners evaluate new ideas, and relate them to conclusions.	Learners have difficulty making sense of new ideas that are different from what they encountered in the textbook.
Deep learning requires that learners understand the process of dialogue through which knowledge is created, and they examine the logic of an argument critically.	Learners treat facts and procedures as static knowledge, handed down from an all-knowing authority.
Deep learning requires that learners reflect on their own understanding and their own process of learning.	Learners memorize without reflecting on the purpose or on their own learning strategies.

Figure 3 Deep learning versus Traditional classroom practices

Source: Sawyer, R. K. (Ed.). (2005). The Cambridge handbook of the learning sciences. Cambridge University Press.

The deep learning approach proposed by Sawyer emphasizes the core principles of deep learning and promotes a more meaningful and efficient learning process.

The benefits of deep learning are broken down into the following:

1. Emphasis on knowledge integration: It emphasizes that learners combine new knowledge with existing knowledge and experience, which helps to build a more comprehensive and in-depth knowledge system.

2. Focus on thinking skills: emphasizing the search for patterns, basic principles, and critical thinking, encouraging learners not only to memorize but also to understand and apply knowledge.

3. Promote independent learning: Learners are encouraged to take the initiative to evaluate and reflect on their own understanding and teaching methods and cultivate the habit of independent learning.

4. Promote understanding and creative thinking: Valuing learners' ability to understand new concepts and think creatively helps develop higher-level cognitive skills.

Sawyer believes that in traditional teaching methods, learners treat course materials as scattered fragments unrelated to known content, tend to memorize facts and perform procedures without in-depth understanding mechanically, and need help in accepting new concepts different from textbooks. In traditional teaching methods, learners regard knowledge as static and authoritative and lack purposeful and autonomous learning strategies in memory.

So deep learning is a way of learning to deeply understand and apply knowledge, rather than just memorizing and exam-oriented education on the surface. This learning style focuses on developing students' critical thinking, creative thinking, and problem-solving skills, which helps them achieve better results in different fields and develop more integrated cognitive skills.

Laursen et al. (2014) adopted a quasi-experimental design in the student experiments for mathematics courses and divided the courses of the four campuses into IBL courses and non-IBL courses. Data on more than 100 courses at these campuses were collected between 2008 and 2010, culminating in the observation of 42 course sections. Professionals observed each course. They rate the class atmosphere and the direct interaction between teachers and students. A series of survey measures were taken before and after the class: student attitudes, beliefs, methods of learning mathematics, and students' learning outcomes were assessed after the class, resulting in findings on classroom practice and student achievement, and gender differences, which demonstrated the advantages of the IBL curriculum.

Regarding classroom performance, Laursen et al. (2014) research results show that: IBL courses also exhibited enhanced student leadership, increased student engagement in questioning, and a greater diversity of classroom activities. IBL courses are student-centered, and the initiative of class is in the hands of students, who can have more practice and discussion, while NON-IBL students only have 13% of class time. Teachers spend the rest of the class time in lectures.

In terms of the overall performance of students, Laursen et al. (2014, p. 7) research results show that students' performance in non-IBL courses is lower than that of students in IBL courses.

Regarding gender differences, the researchers made a learning benefit graph classified by gender. The results showed that: IBL approaches equalized learning opportunities for both genders, providing equally beneficial experiences for men and women, whereas non-IBL courses were disproportionately discouraging and less effective for women (Laursen et al., 2014).

Different from the feeding education of traditional teaching methods, IBL is student-centered in teaching methods, emphasizing that students should actively participate in exploration and discovery, and teachers should act as guides and facilitators. IBL encourages students to analyze, draw their conclusions from learning, and gain the ability to solve problems.

Regarding teaching mode, inquiry-based learning is superior to traditional teaching methods, allowing students to create truly meaningful learning.

2.2.4 Types of Inquiry-based Learning

Banchi & Bell (2008) argued that there are four types or levels of inquiry-based learning, known as the four-level continuum.

At the first level, confirmation inquiry: Students are given a specific question to investigate and extract the results. In this method, teachers should strengthen students' ideas, introduce questions, or ask students to practice exploring a specific skill, and then collect and record data. This approach focuses on confirming or validating facts or principles.

At the next level, structured inquiry: Students are allowed to investigate an issue within a pre-determined framework, but they have some freedom to explore and make decisions. Students are provided with clear procedures or steps to follow, but they are actively involved in the process.

At the third level, guided inquiry: Students are given a research question, but they must design their survey, choose a research methodology, and take a test about data collection and analysis to get answers to their questions. This approach provides more student autonomy and develops thinking and problem-solving skills.

At the fourth level, open inquiry: Open inquiry provides students with a wide range of research questions or issues and a high degree of autonomy in designing and conducting investigations. Students are accountable for developing research questions, designing experiments, gathering and analyzing data, and drawing conclusions.

Confirmatory inquiry and structured inquiry are more common in elementary school science curricula because they enable them to develop the transition to higher levels of inquiry learning gradually. Compared with the first two methods, the third level of guided exploration has increased the participation of students. This method is the most successful when students can participate more in school and practice in different ways. The fourth level of open inquiry is more difficult, and students have higher requirements in all aspects of cognitive ability. Carry out the level and can only after the

first three levels of inquiry (Banchi & Bell, 2008). In inquiry-based learning, teachers only use one of the four levels to conduct inquiry (Zubaidah; Fuad; Mahanal & Suarsini, 2017).

According to the teaching characteristics of this study, guided inquiry is a more appropriate choice.

2.2.5 Models of Inquiry-based Learning

Two scholars, Atkin and Karplus, proposed a structured teaching process-learning cycle (SCIS) in the 1960s. The learning cycle is divided into three stages: Exploration, Invention and Discovery (Bybee, R. W, et al. 2006).

Bybee, R. W et al. (2006) learned from the SCIS Model and added two stages to the three stages of the SCIS model to get the final 5E Instructional Model (Table 4).

Table 4 Comparison of SCIS and BSCS Instructional Models

SCIS Model	BSCS 5E Instructional Model
	Engagement (new phase)
Exploration	Exploration (modified form SCIS)
Invention (term Introduction)	Explanation (modified form SCIS)
Discovery (concept Application)	Elaboration (modified form SCIS)
	Evaluation (new phase)

Bybee, R. W et al. (2006) designed a 5E Instructional Model that can be used across disciplines based on the SCIS model (Figure 4). This model is based on the constructivist view of learning, which constructs knowledge and meaning from experience. Teaching with this model enables students to redefine, reorganize, elaborate, and modify their initial concepts through self-reflection and interaction with peers and the environment (Bybee, R. W, et al., 2006).

The 5E Instructional Model is divided into five phases: Engagement, Exploration, Explanation, Elaboration, and Evaluation.

Phase	Summary
Engagement	The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.
Exploration	Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.
Explanation	The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.
Elaboration	Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

Figure 4 Summary of the BSCS 5E Instructional Model

This teaching model has been used to design BSCS course materials since the late 1980s and can be used to develop curriculum and course materials in science classrooms (Bybee, et al., 2006).

The BSCS 5E Instructional Model is a complete learning cycle. The key to this educational process is to inspire deep learning and understanding in students by triggering curiosity, exploration, interpretation, application, and assessment. When using this model for teaching, teachers should learn to guide students to have meaningful, inquiring learning so that they can build a knowledge system based on their existing knowledge.

2.3 The Relationship between Inquiry-based Learning and Creative Thinking

In the learning of science curriculum, inquiry-based learning stands as the most fundamental and widely adopted teaching mode, playing a crucial role in fostering students' creative thinking (Meador, 2003; Johnson, 2000 & kind, 2007).

Fatmawati (2017) used 50 first-year students as experimental subjects in his study, divided into control classes (24) and experimental classes (26). In order to measure students' creative thinking, this paper starts with inquiry learning and surveys the relevant question formation by referring to the fluency, flexibility, and originality of creative thinking. The results indicate improvements in all three areas of the inquiry-based teaching class, demonstrating that inquiry-based learning can be an effective method for fostering creative thinking.

In Shao's study (2018), he believes that the purpose of future education is to cultivate students' creativity, but traditional teaching cannot meet this requirement. Only by using inquiry-based teaching methods can students' thinking be cultivated.

Tindangen (2018) conducted a study in Public Secondary School 3 Samarinda, which adopted quantitative research methods and set pre-test and post-test control groups to study whether inquiry-based learning can enhance students' higher-order thinking ability. The study involved 41 female teachers and 80 students (53 females and 27 male) aged 16-18 at the secondary school. Teachers in the experimental group taught students using inquiry-based learning methods, while students in the control

group were taught using traditional methods. The results indicated that the experimental group exhibited higher-order thinking abilities superior to those of the control group. According to Alkhatib (2019), higher-order thinking ability consists of creative thinking, critical thinking, problem-solving thinking, and decision-making thinking.

Sandika & fitrihidajati (2018) introduced exploratory learning in the introductory biology class of biology education, hoping to improve students' creative thinking and shape scientific attitudes. In this paper, they adopted the descriptive quantitative method, which the second-grade student of the biological education department in 2017; the subject of the course is the transfer of the cell, and 25 students are involved in the learning process. The learning process was conducted in the two research sessions in November 2017. In order to determine the improvement of students' creative thinking ability, the study adopted the test design before and after the test and observed the students' curiosity, objectivity, and other scientific attitudes through non-test tools. The results show that the students' innovative thinking ability is greatly improved in the introductory biology class, and the influence of scientific attitude has been made to improve their attitude to science. Sandika & fitrihidajati (2018) is considered an essential part of 21st-century learning and, therefore, must be included in the education process, especially in science education. It has a positive effect on helping students understand scientific concepts, improve their creative thinking ability, and cultivate scientific attitudes. The learning method is considered an effective alternative teaching method, which can provide a more active and more relevant learning experience (sandika & fitrihidajati, 2018).

Oktavia (2019) conducted a study to improve the creative thinking ability of Grade X students on fern materials by learning media-oriented inquiry-based learning methods. The study used a pre-experimental design, using only one class and no control class. The research was carried out in March 2019, involving 22 high school students of X-grade, focusing on the properties of ferns. The study used the same set of designs to assess students' creative thinking ability before and after the experiment. Educational resources encompass lesson plans, student activity sheets, and tools for

assessing creative thinking ability. Moreover, observation tables were employed in the study to document the implementation of learning patterns, student engagement, and tools for assessing creative thinking ability, aiding in data collection and analysis. The research analyzed pre-test and post-test data on creative thinking ability using N-Gain analysis, which evaluates the enhancement of creative thinking ability throughout the learning journey. The findings indicate that students' creative thinking abilities were enhanced through guided inquiry-based learning methods. This finding underscores the capacity of inquiry-based learning to enhance students' creative thinking ability.

Purnawati et al. (2021) studied improving creative thinking among 49 students in grade 4 in Sleman Private Primary School. Two rounds of classroom research were implemented, followed by data collection through observation and questionnaires. The findings reveal that inquiry-based learning approaches can enhance students' creative thinking ability.

Sarnita et al. (2021) conducted a study involving 22 students, employing a pre- and post-test design to investigate the impacts of guided inquiry learning tools on enhancing students' engagement and proficiency in creative thinking. The scope of students' activities includes attention, question raising, hypothesis formation, experiment implementation, observation recording, discussion, exchange of results, and summary. Data were gathered through the use of observation tables for tracking activities and tools designed for assessing creative thinking skills. At the same time, the study focused on the different components of creative thinking ability, including fluency, flexibility, originality, and articulation. The research results reveal that students' activity level and creative thinking abilities are significantly improved after learning, which supports the effectiveness of guided inquiry learning tools in promoting students' activity and creative thinking abilities.

In all, many scholars indicate that there is a positive correlation between inquiry-based learning and creative thinking. Inquiry-based learning can help cultivate students' higher-order thinking skills and thus enhance creative thinking.

Inquiry-based learning can effectively ensure students' curiosity, promote active participation, enhance their interest in learning, enrich the classroom, and make learning lively and interesting.

CHAPTER 3
METHODOLOGY

3.1 Research Design

This study adopts a quasi-experimental design, with inquiry-based learning program as the independent variable and creative thinking as the dependent variable. The study design divided the sample into two groups, the experimental group and the control group. After the pre-test, the experimental group adopted inquiry-based learning program and the control group did not and then compared the results of the post-test. The objective was to investigate the effect of inquiry-based learning program on the creative thinking of culinary nutrition college students. In this study, students' creative thinking was examined by comparing the total average scores of the pre-test and post-test. The program lasted 4 weeks and included pre-test and post-test components.

3.2 Populations and Samples Selection

Population

This study primarily focused on 160 students from the first to the third year majoring in Culinary Nutrition at Hezhou College.

Participant

The samples of this study were 40 students who chosen by purposive sampling, and had mean score of creative thinking form the 25 percentile down. They were randomized to the experimental group and the control group equally (20 students in each group). The experimental group was provided by inquiry-based learning program, while the control group was not. In order to ensure the reliability of the research results, there are no significant differences in age and academic performance between the two groups of students.

3.3 Research instruments

The two parts of the instrument used to obtain research data were the inquiry-based learning program (IBLP) and the Creative Thinking Test. The Creative Thinking

Test was used to measure the impact of inquiry-based learning program on creative thinking.

Inquiry-based learning program (IBLP)

This is an educational approach centered around students, combining theory with practice. It mainly cultivates students' independent learning ability and learns to find problems to build their knowledge. This teaching method breaks the traditional teacher-led unilateral indoctrination-teaching mode, effectively guarantees students' curiosity, promotes students' active participation, stimulates students' thirst for knowledge, enrich the classroom and makes learning lively and interesting. The passive absorption method in teaching is avoided, allowing students to actively participate in the learning process, which enhances their engagement and experience. The implementation of inquiry-based learning program consists of five stages: Engagement, Exploration, Explanation, Elaboration, and Evaluation.

In this study, the five stages of inquiry-based learning program run through the whole classroom, forming five teaching steps, and enumerating the behaviors of teachers and students in each teaching step in detail, so as to build the design of inquiry-based learning program as shown in Figure 3.

Step1 Engagement: Before the beginning of the course, teachers raise questions or situations to stimulate students' previous knowledge and guide learners to develop in the right cognitive direction to ensure students' attention and increase their interest in knowledge inquiry to promote the acquisition of new knowledge.

Step2 Exploration: To provide students with common activity base, students based on existing knowledge through preliminary investigation to promote conceptual change. Learn new knowledge through investigation and use previous knowledge experiences to generate new ideas.

Step3 Explanation: Opportunities need to be provided at this stage for students to share what they have learned during the exploration phase. The teacher then introduces the concept, demonstrates the process or skills directly to the student. The learner explains their understanding of the concept or presentation process, while

the teacher interprets the learner's understanding and leads them to further understanding.

Step4 Elaboration: At this stage, to expand students' conceptual understanding and related skills. Allow students to better master skills and behaviors through hands-on experience, so as to gain more information and have a deep understanding of the problems encountered.

Step5 Evaluation: Through multiple evaluations such as teacher-student and student evaluations, students are encouraged to evaluate their own and others' understanding and abilities, helping students to inspire new ideas and solve doubts. It also provides an opportunity for teachers to assess students' mastery of learning objectives in the teaching method.

The inquiry-based learning program consists of 12 activities and has five stages in each activity: Engagement, Exploration, Explanation, Elaboration, and Evaluation. Improving Inquiry-based learning program based on 3 experts' opinions and selected the content approved by the experts for implementation. A pilot study was conducted to determine whether the students understood the content.

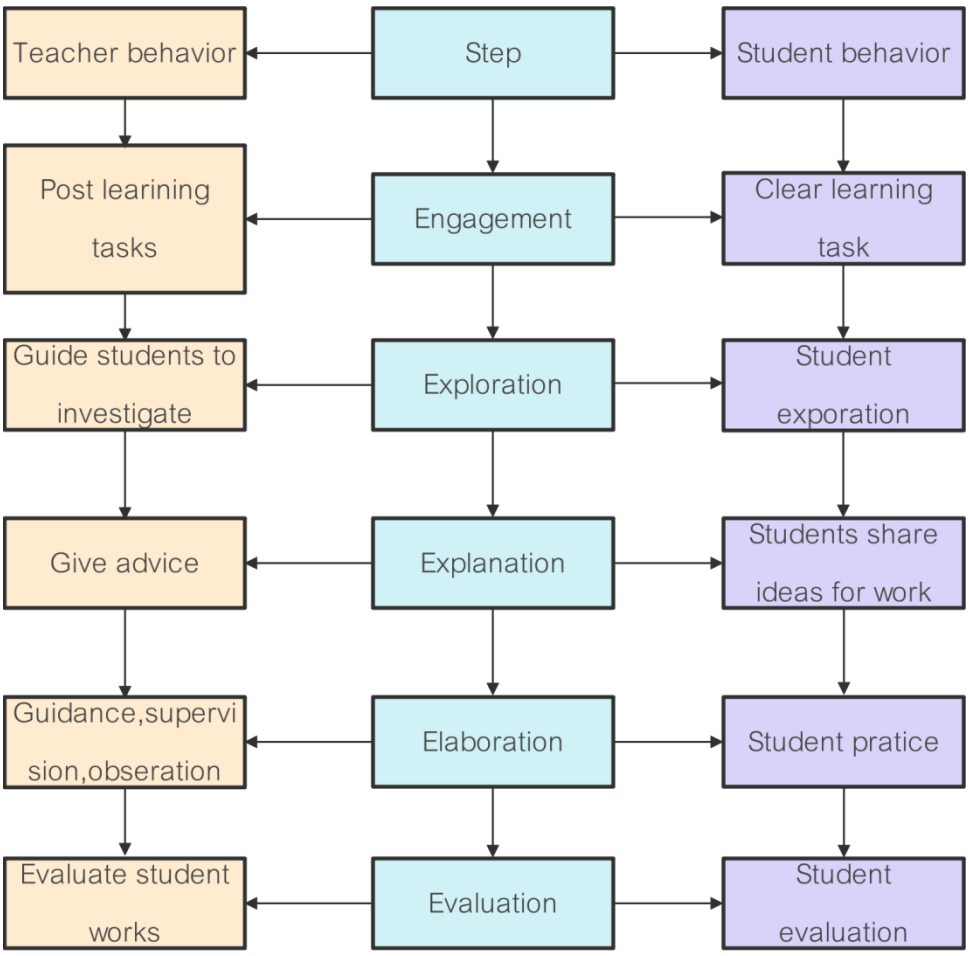

Figure 5 Inquiry-based learning program design

This study focuses on the culinary profession and the presentation of the finished product. Therefore, this study takes the creative thinking test of pictures as the primary research object.

According to the Torrance creative thinking Test and the characteristics of a culinary nutrition major, a test on the creative thinking of college students majoring in culinary nutrition was designed in this study. The test consists of three parts: Build the picture, complete the pictures, and draw a line. Each section takes ten minutes to complete (refer to Appendix 1). Improving Creative thinking test based on 3 experts opinion. The index of item objective consistency (IOC) was used to check the content validity with the value of 0.67 up were selected. By using B-Index 700 program, the Creative Thinking Test had a total reliability of 0.74 with a difficulty index (P) was 0.49 -

0.51 and a discrimination index (D) was 0.38- 0.46. The result showed that Creative thinking test developed in this study can used properly. The designed test will be pre-tested and post-tested before and after the teaching experiment. The test must be completed independently and carefully. The test should be completed according to the instructions of the tester within the required answering time. Finally, the researchers rated the students' creative thinking ability based on three indicators: fluency, originality, and elaboration. Fluency refers to the degree of completion of a student's work and the number of creative elements. Originality means that the student's work is new and unique compared with other works. Elaboration is reflected in the degree of fineness of students' work, including careful attention to detail.

3.4 Procedures of the Study

This study adopts the experimental research method, which is divided into three stages: pre-test, Inquiry-based learning program intervention and post-test. The specific process is as follows:

Step1: pre-test

Before the experiment, all the students were pre-tested to understand the basic level of creative thinking. In this study, creative thinking test was used for measurement. After students completed the pre-test within the specified time, test were collected and scored. All subjects completed the first stage of pre-test and entered the next stage.

Step 2: Inquiry-based learning program intervention

In this stage, test students will receive an inquiry-based learning program intervention to explore its impact on the creative thinking of the culinary nutrition specialty course "Technics of dough modeling ".

In this study, the Inquiry-based learning program was implemented to intervene in learning, and the theme content was produced 12 times. Guide students to actively participate in learning and improve their creative thinking by issuing tasks, pre-class homework, and personal practice. The inquiry-based learning program

intervention lasted for four weeks, three times a week for 3 hours each time (See Appendix 2 for inquiry-based learning program design).

Step 3: post-test

After the inquiry-based learning program intervention, all the tested students were post-tested to understand the changes in the creative thinking of the students majoring in culinary nutrition. The post-test was measured using the same Creative Thinking Test as the pre-test.

3.5 Data Collection

The procedure for experiment and data collection is as follows:

First, before the students participate in the inquiry-based learning program, they take the Creative Thinking test to determine their initial results.

Secondly, after participating in the inquiry-based learning program, the learners completed the Creative Thinking Test again to gauge the outcomes of the post-test.

3.6 Data Analysis

In this study, SPSS statistical software was used for data analysis. For quantitative data, descriptive statistical analysis including mean and standard deviation and independent sample T-test were used to compare and analyze the creative thinking data of the experimental group and the control group and dependent sample T-test were used to compare and analyze the creative thinking data of the experimental group after the experiment. The researchers compared the average values of the two groups.

CHAPTER 4
RESEARCH RESULTS

This chapter introduces the research results in the following order:

1. Result from develop Inquiry-based learning program (IBLP) to enhance creative thinking of culinary nutrition students.

2. Result from study the effect of Inquiry-based learning program (IBLP)

2.1 Compare the difference creative thinking level between experimental group before and after attending inquiry-based learning program.

2.2 Compare the difference in creative thinking level between the control and experimental groups after attending inquiry-based learning program.

1. Result from develop IBLP to enhance creative thinking of culinary nutrition students

In this research, the researcher designed the program employing the principles of IBLP to enhance creative thinking of culinary nutrition students. From previous research studies have pointed out that the inquiry-based learning program can enhance students' creative thinking abilities. As a student-centered teaching method, inquiry-based learning is widely applied in various educational settings. By allowing students to take control of the classroom, fostering a positive classroom atmosphere, and encouraging deep thinking, this model plays a crucial role in stimulating and developing students' creative thinking.

The study designed 12 teaching programs, with the thematic activities gradually increasing in difficulty over the course of the sessions. The first 5 themes require independent student completion, followed by themes 6 to 8, which involve completion in groups of 2, 2 to 3, and 4 respectively. Subsequent themes, 9 to 10, require completion in groups of 5, while themes 11 to 12 are completed in groups of 10. This progressive increase in difficulty ensures that students are challenged within feasible boundaries and can fully comprehend the material they are learning.

The teaching program included both teacher guides and student guides. The teacher guide provides necessary information about the inquiry-based learning

program, including teaching content, objectives, required teaching materials and tools, as well as detailed descriptions of the steps involved in the inquiry-based learning program. This helps teachers effectively prepare and organize classroom teaching, ensuring smooth progress of the teaching process and maximizing student learning outcomes and development.

The student guide primarily provides necessary information about the inquiry-based learning program for students participating in the program, including the theme content, requirements, and the number of participants for each session.

The teaching process consists of 5 steps, and the detailed information for each step is as follows:

Step1 Engagement: By asking questions or setting up situations, teachers use teaching tools to stimulate students' curiosity and promote their re-understanding of existing knowledge. This guides students to understand new concepts and ensures that they remain focused, thereby stimulating their interest in exploring knowledge and facilitating the acquisition of new knowledge. This first stage made students interested and create motivation for students to think creatively.

Step 2 Exploration: By providing a common base of activities for students to make an initial investigation of existing knowledge, they can facilitate a change in their perceptions. Through this kind of investigation, students have the opportunity to learn new knowledge, and in this process, students use previous knowledge and experience to generate more on new ideas and enhance creative thinking ability.

Step 3 Explanation: In this stage, students share their ideas and present their design program, including the details of their creativity and design concepts. Through mutual sharing, if similar works are found among classmates, adjustments can be made to ensure each student's work is unique and not repetitive. The exchange and collision of ideas will make students' thoughts more unique and creative, further enriching and refining their creativity, laying a solid foundation for subsequent creations of truly unique works.

Step 4 Elaboration: Allow students to engage in practical exercises, creating artworks using dough modeling based on their design ideas. Within the designated time frame, students are required to complete their works and continually add more details to enhance their skill mastery and better convey the meaning behind their creations. As the artworks are presented, the details serve as a means to better interpret them, showcasing the development of students' skills and their demonstration of creative thinking.

Step 5 Evaluation: Experience internalization and sharing. Students are required to present their work and share their creative experience. Through mutual communication and sharing of learning experience among students, it can promote the creative of ideas. Such interaction helps to improve students' creative thinking ability.

The descriptive conclusions of the five steps are shown in the table below. For more details, please refer to Appendix 2.

Table 5 Inquiry-based Learning program Model Description

Step	Teacher behavior	Student behavior
Step 1 Engagement	The teacher issues an inquiry-based learning plan, guides students to read the task file, determines the activity theme, and informs students of the task requirements.	Reading the task file and preparing and executing accordingly based on the activity theme and task requirements determined by the teacher.
Step 2 Exploration	Provide students with avenues for exploration and help them better understand the topic through examples.	Students generate ideas through independent exploration and draw their ideas in the student program guide.
Step 3 Explanation	Students are required to present their works, including the name, appearance, features, and details of the creative elements introduced in the design.	In their design drafts, students will select the design they consider the most creative, present the design drawings in class, and introduce their works, explaining the creative concepts behind them.
Step 4 Elaboration	Guide, observe and supervise	Practice
Step 5 Evaluation	Actively identify the strengths in students' works, offer praise and encouragement, and inspire them to strive harder for their next activity.	Students select the best work in the classroom and evaluate its strengths. At the same time, they assess the strengths and weaknesses of their own work.

2. Result from study the effect of IBLP

The data is collected from three evaluation indicators for creative thinking. They include: (1) originality, (2) fluency, and (3) elaboration.

Analyze the data to test the following research hypotheses:

Assumption 1: After participating in inquiry-based learning program, the experimental group has a higher level of creative thinking than before.

Assumption2: After participating in inquiry-based learning program, the experimental group had a higher level of creative thinking than the control group.

The first step in data organization by researchers is to collect creative thinking scores from 160 students and select 40 students scoring below the 25th percentile. They are then randomly divided into an experimental group and a control group, each comprising 20 students. The experimental group were participating in inquiry-based learning program, while the control group does not. Finally, after the program concludes, creative thinking scores are collected again from the 40 students, and SPSS is used for data analysis to validate hypotheses. The implementation results are analyzed as follows.

Table 6 The t-test score of creative thinking between experimental group and control group before using Inquiry-based learning program

Creative Thinking	Experimental group pretest (N=20)		Control group pretest (N=20)		t	p
	$\overline{X}$	S.D	$\overline{X}$	S.D		
originality	3.65	1.35	3.20	1.36	1.050	0.300
fluency	3.50	0.89	3.60	0.60	0.000	1.000
elaboration	3.75	0.85	3.85	1.23	-0.300	0.766
Total	10.90	2.00	10.65	1.57	0.441	0.662

The data showed that the total score of creative thinking ability in all dimensions of the experimental group and the control group were p>0.05, suggesting that before the implementation of the inquiry-based learning program, the development of creative thinking ability was not difference between the two groups of students. Consequently, the learners in the experimental group could be structured to participate in the inquiry-based learning program.

Research question 1: Is the average score of creative thinking in the experimental group higher than before participating in the program?

Table 7 The t-test score of pre-test and posttest of creative thinking ability in experimental group

Creative Thinking	Experimental group pretest (N=20)		Experimental group posttest (N=20)		t	p
	$\bar{X}$	S.D	$\bar{X}$	S.D		
originality	3.65	1.35	8.20	1.01	-11.965**	<0.001
fluency	3.50	0.89	4.90	0.31	-6.658**	<0.001
elaboration	3.75	0.85	7.80	1.51	-10.650**	<0.001
Total	10.90	2.00	20.90	1.90	-20.106**	<0.001

**p < .001

By conducting a paired-samples t-test on the experimental data. The results showed that the mean score of the pre-test for the experimental group was 10.90, accompanied by a standard deviation of 2.00, while the mean score of the post-test was 20.90, accompanied by a standard deviation of 1.90. There is a significant difference (p<.001) between the two sets of data, including the mean (x) and standard deviation (S.D.) From the data, it can be observed that after attending inquiry-based learning program, students in the experimental group showed the greatest improvement in originality (8.20), followed by elaboration (7.80), and finally, fluency (4.90), in terms of creative thinking dimensions.

The data in the table indicate that there were statistically significant differences at the .01 level in all three dimensions of creative thinking for students in the experimental group after participating in the inquiry-based learning program. (Originality $\bar{X}$=8.20 S.D=1.01, fluency $\bar{X}$=4.90 S.D=0.31 and elaboration $\bar{X}$=7.80 S.D=1.51)

The test results are consistent with Research Hypothesis 1, which states that after participating in inquiry-based learning program, the experimental group has a higher level of creative thinking than before. The experimental results demonstrate that the inquiry-based learning program effectively enhances students' creative thinking. The research findings support the first research hypothesis.

Table 8 The t-test score of pretest and posttest of creative thinking ability in control group

Creative Thinking	Control group pretest (N=20) $\bar{X}$	S.D	Control group posttest (N=20) $\bar{X}$	S.D	t	p
originality	3.20	1.36	4.30	1.08	-2.820	0.011
fluency	3.60	0.60	2.85	0.60	5.252	<0.001
elaboration	3.85	1.23	2.50	0.83	3.500	0.002
Total	10.65	1.57	9.65	1.73	1.859	0.079

The pre-and post-test data of students in the control group were tested by paired sample t-test. The total pre-test score was 10.65, and the total post-test score was 9.65. Although there were significantly differences in some components, with 2 components decreasing and 1 component increasing. But overall, the pre-and post-test data showed that there was no significant difference between the total scores of the control group. (p=0.079)

Research question 2: After participating in the program, is the average score of creative thinking in the experimental group higher than that in the control group?

Table 9 The t-test score of posttest of creative thinking ability between experimental group and control group

Creative Thinking	Experimental group posttest (N=20)		Control group posttest (N=20)		t	p
	$\bar{X}$	S.D	$\bar{X}$	S.D		
originality	8.20	1.01	4.30	1.08	11.816**	<0.001
fluency	4.90	0.31	2.85	0.60	13.829**	<0.001
elaboration	7.80	1.51	2.50	0.83	13.782**	<0.001
Total	20.90	1.90	9.65	1.73	19.666**	<0.001

**p < .001

The results obtained from the independent sample t-test comparing the post-test scores of the experimental group with those of the control group are presented in Table 9 above. The experimental group students who participated in the inquiry-based learning program had higher creative thinking ability than the control group students who did not participate in the learning program with statistically significant at the p-value < .001 in all components. The statistical significance across various dimensions for the experimental group students who participated in the learning program reached the .01 level. (Originality $\bar{X}$=8.20 S.D=1.01, fluency $\bar{X}$=4.90 S.D=0.31 and elaboration $\bar{X}$=7.80 S.D=1.51)

The experimental results indicate that the experimental group's level of creative thinking was higher than that of the control group at the end of the experiment. This finding validates Research Hypothesis 2, after participating in inquiry-based learning program; the experimental group had a higher level of creative thinking than the control group. These experimental results suggest that inquiry-based learning program can enhance creative thinking.

CHAPTER 5
CONCLUSION AND DISCUSS

5.1 Objectives of the Study

The research conducted for the purpose as follow:

1. To develop Inquiry-based learning program (IBLP) to enhance creative thinking of culinary nutrition students.

2. To study the effect of Inquiry-based learning program (IBLP)

2.1 Compare the difference creative thinking level between experimental group before and after attending inquiry-based learning program.

2.2 Compare the difference in creative thinking level between the control group and experimental group after attending inquiry-based learning program.

5.2 Research Hypothesis

For the purpose of the study, the following assumptions were used:

5.2.1 After participating in inquiry-based learning program, the experimental group has a higher level of creative thinking than before.

5.2.3 After participating in inquiry-based learning program, the experimental group had a higher level of creative thinking than the control group.

5.3 Research Method

This study used a quasi-experimental pretest-posttest design, with inquiry-based learning program as the independent variable and creative thinking as the dependent variable. The study design divided the sample into two groups, the experimental group and the control group. After the pre-test, the experimental group was provided with the inquiry-based learning program but the control group was not and then compared the results of the post-test. The objective was to investigate the effect of inquiry-based learning program on the creative thinking of culinary nutrition college students. In this study, students' creative thinking was examined by comparing

the total average scores of the pre-test and post-test. The program lasted 4 weeks and included pre-test and post-test components.

5.4 Conclusion and Discussion

5.4.1 Conclusion

1. To develop Inquiry-based learning program (IBLP) to enhance creative thinking of culinary nutrition students.

This course adopts the inquiry-based learning 5E model and designs a series of activities to cultivate students' creative thinking. The 5E model consists of five steps: Engagement, Exploration, Explanation, Elaboration, and Evaluation. In each activity, students first gather inspiration from various resources such as picture books and the internet, then proceed to design and create, and finally present and evaluate their work.

The specific process is as follows:

Step1: Engagement: Students are provided with an inquiry-based learning plan, acting as a student guide where they can learn about the content and requirements of each theme.

Step 2: Exploration: Students generate creative ideas through reading, researching, and other methods, and document their ideas in the inquiry-based learning plan.

Step 3: Explanation: Students introduce their designs, detailing the name and creative elements, while the teacher provides basic demonstrations.

Step 4: Elaboration: Students use dough modeling to bring their designs to life.

Step 5: Evaluation: Students showcase their work and engage in peer and teacher evaluation.

A total of 12 theme topics were designed, each aimed at sparking students' unique imaginations and encouraging them to break conventions while learning. The teaching steps for each theme were implemented according to the 5E model.

2. To study the effect of IBLP

For assumption 1, the analysis of the results of the average score of the experimental group before and after participating in the program is as follows:

The findings suggest a notable enhancement in the creative thinking abilities of students in the experimental group following their involvement in the inquiry-based learning program, compared to their state before participation. The differences in scores across various dimensions were statistically significant at the .01 level. The difference in scores of creative thinking level for students in the experimental group before and after the test suggests an improvement in creative thinking after completing the inquiry-based learning program. The research findings support the first research hypothesis.

For assumption 2, the comparison results of the average creative thinking scores of the experimental group participating in the program and the control group not participating in the program are as follows:

The findings suggest that students in the experimental group, engaged in the inquiry-based learning program, achieved higher scores compared to those in the control group who did not participate in the program. These differences were statistically significant at the .01 level across multiple dimensions.

On the levels of creative thinking across dimensions, students who attending the inquiry-based learning program scored higher in creative thinking tests compared to students who were not. This suggests that inquiry-based learning program are effective in enhancing students' creative thinking ability. The research findings support the second research hypothesis.

5.4.2 Discussion

From Research objective 1, Design the inquiry-based learning program (IBLP)

The inquiry-based learning program is student-centered. In this study, the program activities focus on the learning progression of students. This method mainly cultivates students' advanced thinking and independent learning ability. Students need

to participate in the learning process actively, learn to identify problems, think deeply, and build their knowledge in the process of inquiry. The program consists of five parts: classroom learning objectives, teaching focuses and difficulties, learning tools, teaching steps (5E Instructional Model), and classroom summary.

The results of this study suggest that inquiry-based learning program can enhance the creative thinking ability of college students. According to Nurlaela et al. (2018), Inquiry-based learning is an ideal method for developing creative thinking and innovation ability. Teachers should skillfully utilize the five instructional steps of inquiry-based learning program to enhance students' creative thinking ability.

Step 1 Engagement: Teachers can convey some unconventional information to students by posing questions or creating situations, allowing learners to feel that they are engaging in challenging learning, thereby stimulating their curiosity and motivation, and fostering creative thinking.

Step 2 Exploration: According to Michalopoulou (2014), curiosity itself does not automatically lead to learning. Teachers should encourage learners to ask questions and think critically, providing them with opportunities to plan, observe, collect, process, and interpret data in order to draw and present conclusions, thereby enhancing learners' desire to explore. Teachers need to broaden learners' horizons and expose them to new and meaningful experiences. By doing so, students gradually acquire the fundamental skills of investigation and begin to conduct more systematic inquiry. At this stage, teachers can provide students with a common activity base, allowing them to conduct preliminary investigations of existing knowledge, which can help facilitate changes in their perspectives and enable them to generate more new ideas based on previous knowledge and experiences, thereby enhancing their creative thinking ability.

Step 3 Explanation: In this phase, teachers integrate students' ideas to establish a shared understanding of the inquiry-based learning program theme. They encourage students to boldly share their views and discuss the creative aspects of their work. During this process, teachers should ask students open-ended questions to

encourage creative thinking. According to Rodríguez (2019), creativity is a collaborative social phenomenon that emerges through interaction and discussion. Therefore, teachers can guide students in group discussions and collaborative activities, fostering mutual learning, communication, and the exchange of ideas within teams. To better stimulate students' creativity and ensure they benefit from the discussions, teachers can design sharing sessions where students present their ideas and introduce their design program, including creative details and design concepts. Through mutual sharing, if similar works are found among classmates, adjustments can be made to ensure each student's work is unique and not repetitive. The exchange and collision of ideas will make students' thoughts more unique and creative, further enriching and refining their creativity, laying a solid foundation for subsequent creations of truly unique works.

After going through the above three stages and other instructional steps, learners can experience growth in the originality and fluency of their creative thinking.

Step 4 Elaboration: In this phase, students can actively explore problem solving. As they proceed, students use their ideas and the information collected during the exploration stage, as well as their design sketches, to create their own dough sculpture works. They can also improve their work and address issues through collaboration with peers. According to Michalopoulou (2014), creativity emerges when students engage in the practice of learning activities or explore their own ideas. Students express their thoughts in various ways and use different media and materials to craft and transform objects. They consciously add diverse details to their work, thereby advancing the elaboration of their creative thinking.

Step 5 Evaluation: Students need to showcase their work and share their creative experiences. When presenting their work in groups or individually, learners can engage in mutual exchange and learning through evaluating and discussing each other's works. This not only helps them accumulate experience and knowledge but also allows them to gain new insights from others, thereby improving and refining their own work.

Rodríguez (2019) stated in his article that inquiry-based learning is an approach centered around students and the best method for fostering creative thinking. The whole teaching activities started with stimulating students' curiosity and putting forward exploratory open-ended questions for students to participate in the investigation, active learning, and problem solving. In learning, students could skillfully use their knowledge and skills from multiple perspectives to create creative works and enhance their creative thinking ability. Through exercises, students can combine life experience with the class, cultivate their spirit of active exploration, and enhance their love for dough molding craft courses. Teachers should learn to let students set goals, draw on existing knowledge and let students take more responsibility for their learning. The learning pattern is characterized by the student being at the core of the classroom, as well as being student-centered and promoting student active learning (Asy'ari et al, 2021).

Furthermore, the purpose of inquiry-based learning is to create an attractive and positive learning environment (Friesen & Scott, 2013). Hamza & Griffith (2006) found through creative teaching and analytical teaching that students prefer a relaxed and comfortable learning atmosphere rather than an authoritative and rule-following environment. Students like to listen to their teachers; they show emotion and dislike teachers who give orders and make demands. An open atmosphere and an inspiring and supportive environment need to be created for students to keep striving in their studies to become independent thinkers and problem solvers. When designing inquiry-based learning activities, you should first ask questions and then explore solutions. In the process of gathering and understanding information, new knowledge is created, discoveries and experiences are discussed, and newly discovered knowledge is reflected (Savery, 2015).

In this study, the aim is to create a more positive learning environment for students through the use of inquiry-based learning, providing them with more opportunities for exploration to acquire new skills and knowledge. In this learning environment, students can be inspired by creative thinking through independent

practice. According to Sarnita et al. (2021), their research results proved that students' activity and creative thinking ability can be improved by using inquiry-based learning in teaching, which proves that inquiry-based learning is effective in improving creative thinking.

From Research objectives 2, Study the effect of using the effects of inquiry-based learning program on creative thinking of culinary nutrition college students

Hypothesis 1 After participating in inquiry-based learning program, the experimental group has a higher level of creative thinking than before.

By comparing the differences in the level of creative thinking among the students participating in the experimental group, their pre-intervention and post-intervention scores are analyzed. The research data show that the creative thinking level of students in the experimental group after completing the inquiry-based learning program has increased nearly twice compared with the pre-test, which confirms that the inquiry-based learning program is effective in improving the creative thinking level of students. The research results support the first research hypothesis.

In this study, students' creative thinking is assessed mainly across three dimensions.

IBLP fosters the development of students' originality.

Originality means that the student's work is new and unique compared with other works. For example, in the first activity of the Creative Thinking Test, students created by imagining and drawing the overlapping of one large and one small circle as a basic graphic. Most students interpreted it as part of a flower, bear, pig, and other objects, while others viewed it as a human face, target, turtle, and other novel objects. These expressions all demonstrated students' creative thinking. Students' unique ideas and works fall within the realm of originality. Before and after the experiment, students showed the greatest change in originality across three dimensions. Before the test, students had limited knowledge and could only complete works based on their surroundings or sudden bursts of thought in their minds. However, in the post-test, students experienced intervention from an inquiry-based learning program, which

increased their understanding of new things and significantly enhanced their originality. Compared to the control group, students in the experimental group demonstrated greater originality, suggesting that the inquiry-based learning program had a beneficial impact on fostering learners' creative thinking.

In inquiry-based learning program, the key to enhancing students' originality lies in students' understanding of rich knowledge and exposure to various fields, which allows them to generate unique ideas. According to scholars Hamza & Griffith (2006), teachers can use current events, employ metaphors or analogies, or tell personalized stories. These methods not only pique students' interest but also help them broaden their horizons and deepen their understanding of knowledge. Stimulated by various methods, students may develop unique ideas about the theme, deepen their exploration, and continuously add new details and perspectives to their thinking. For instance, in the first theme activity "The Strangest Pumpkin," a student created a unique pumpkin train inspired by current events. This train goes to the northern Chinese city of Harbin and the southern Chinese province of Guangxi. Next to the train stands a frozen pear representing Harbin and a mandarin orange symbolizing Guangxi. They stand side by side like friends, symbolizing the friendly relationship between northern and southern China and the unity of northern and southern ethnic groups.

Throughout the teaching process, students should be encouraged to maintain questioning and exploration, constantly challenging their established ways of thinking. This allows students to overcome fixed thinking patterns when encountering different things, engage in divergent thinking, and enhance the originality of their creative thinking. Dollinger (2007) points out that if learners are overly conservative, their creativity will be restricted. The key to fostering creativity lies in abandoning inherent notions, breaking free from conventions, and becoming a learner with liberated thinking.

IBLP promotes the development of students' fluency.

Fluency refers to the degree of completion of a student's work and the number of creative elements. In this study, researchers found that a key issue among students is their lack of ability to establish connections between concepts, leading to

relatively limited and one-dimensional thinking. Therefore, the role of the teacher is crucial in guiding students during the learning process. During the exploration phase, teachers should provide ample guidance to help students consciously think, break free from entrenched thought patterns, and generate more ideas (Dijksterhuis, 2004). For example, in the third theme "Never-fading rose," teachers guide students not to be confined by the physical phenomenon of the rose never withering but to think of the theme as not just a physical phenomenon but also a symbol and metaphor. This guided approach to thinking can help students explore the theme from different angles and inspire more creativity and ideas. Banchi & Bell (2008) argue that through guided inquiry, students gain more autonomy while also fostering their abilities in critical thinking and problem solving. In the final design, each student completed the required 20 ideas of roses, with some students even exceeding the drawing requirements. Similarly, in the Creative Thinking Test activity three, the semicircle in the activity helps individuals generate unique ideas. In inquiry-based learning program, students can also draw various different answers, which reflects the fluency of their thinking.

The key to enhancing students' fluency lies in their ability to engage in divergent thinking consistently. According to Runco (2008), divergent thinking involves envisioning problems from different directions, pathways, and perspectives to explore multiple answers. Its characteristics include leveraging imagination fully, branching out from a single point into various directions and angles, and advancing thinking through the recombination of knowledge and concepts (Guilford, 1950). Although past life experiences can offer us many insights, they can also influence our subconscious judgments in life and work (Vygotsky, 2004). With society continually evolving and environments constantly changing, many factors are in flux, necessitating learners and researchers to continuously adjust their cognition, break old beliefs, and thinking patterns. By maintaining an exploratory spirit and an open mindset, continuously enhancing cognitive levels, and increasing wisdom, individuals can expand their cognitive space (Dweck, 2006).

In teaching activities, teachers can explain the significance of the topic to students, encouraging them to unleash their imagination and boldly express their ideas. According to Bruner (1990), students should learn to create knowledge and construct their understanding of it rather than having it imposed through direct teaching by teachers. By continuously autonomously reorganizing their understanding of the topic, students enrich their imagination, thereby achieving a more effective enhancement of fluency.

The results from before and after the experiment show that the creative thinking of students in the experimental group significantly improved, indicating that inquiry-based learning program can help students expand their thinking and promote the enhancement of students' fluency in thinking. Sarnita et al. (2021) conducted a study involving 22 students, utilizing pre-test and post-test designs to explore the impact of guided inquiry learning tools on enhancing students' creative thinking activities and ability. Different components of creative thinking ability were examined, including fluency, flexibility, originality, and elaboration. The results of the study indicated a significant improvement in both students' activity levels and creative thinking ability after the intervention, supporting the effectiveness of guided inquiry learning tools in enhancing student fluency.

IBLP promotes the development of students' elaboration.

Elaboration refer to reflected in the degree of fineness of students' work, including careful attention to detail.

In this study, students were engaged in hands-on practice, using dough to create art pieces based on their imagination. Imagination can continuously create new levels and combinations, but it requires the use of materials from reality to bring them to life (Vygotsky, 2004). They were required to complete their works within a given timeframe and continuously add details to improve their skill mastery and better convey the meaning behind their creations. When presenting their work, details serve as a means to better interpret the pieces, showcasing the development of the students' skills and their creative thinking. Treffinger et al. (2002) define elaboration as the ability to

make ideas or works richer, more interesting, and more complete through the addition of details.

Experimental data show that there is a significant difference in the elaboration dimension for students in the experimental group between the pre-test and post-test. Elaboration is reflected in the degree of fineness of students' work, including careful attention to detail. For example, in the Creative Thinking Test activity, elaboration scores consider not only basic stimulus responses but also the evaluation of other details. If the student's drawing is meaningful, it is important to assess whether they have added details. For each additional meaningful embellishment, the elaboration score increases by one point, primarily reflecting the refinement of the student's thought process. Before the experiment, students' mastery and attention to detail were relatively low, leading to lower pre-test scores. After the intervention, students began to pay more attention to details in their work, which not only showcased the features of their pieces but also allowed them to apply their creativity. For example, in the fourth theme," Monster Appearance," researchers guided students in the classroom to perceive and observe the impact of their works, encouraging them to continuously expand their thinking and add new content to their creations. The process of creativity is always unfinished, usually subject to setbacks, corrections, and constant improvement (Robinson & Lee, 2011). Students completed the main part of their works based on their understanding, and then continued to add details, constantly refining and enriching their pieces. Divergent productivity also involves the development of numerous possibilities, which primarily stem from shifts in personal perception and thinking. Throughout this process, ideas become richer through the addition of details and expansion (Treffinger et al., 2002).

Research results indicate that the creative thinking ability of culinary nutrition students improved in all dimensions after the experiment.

The change of students' creative thinking in this experiment mainly depends on reasonable teaching design based on inquiry-based learning program. This program created 12 themed activities that determine the purpose and method based on

students' interests and professional characteristics. These themes can solve students' questions in the course and are consistent with students' existing experience; so that students have a high sense of identity with the created themes and show a strong desire to explore. Some scholars believe that inquiry-based learning is a teaching method that combines students' curiosity to promote the development of students' higher-order thinking ability while learning (Warner & Myers, 2009; Tindangen, 2018).

In the first three thematic activities, teachers help students get started by demonstrating the basic shape of the theme and explaining key points. Teachers encourage students to make independent creative while imitating, to cultivate their creative ability and hands-on ability. This teaching strategy is designed to allow students to continuously develop themselves in progressively enhanced challenges and to gain learning and collaborative experiences from them. Inquiry-based learning is a teaching process that starts with arousing students' curiosity and eventually forms interest and gets results. In this study, 12 themed activities were set up The Strangest Pumpkin, A Magical Enchanted Tree, Never-fading Rose / Withered Rose, Monster Appearance, A Flying Rabbit, World Noodle Beauty Pageant, Cat Known as the Master Chef, The Gift for Totoro, Doraemon's Most Desired Destination, Mr. Pig's Sunshine Party, My Dream Cottage, and The Happiest Dinner Moments. Each activity can stimulate students' infinite imagination, and students can make full use of their existing experience to explore through daily life or exploration network. Inquiry-based learning is an instructional approach centered around students, blending theory with practice. In the activities, emphasis is placed on student experience and participation.

The result conformed with research by Tindangen (2018) who conducted a study that adopted quantitative research methods and set pre-test and post-test control groups to study whether inquiry-based learning can improve students' higher-order thinking ability. The results showed that the higher-order thinking ability of the experimental group was higher than that of the control group. According to Fatmawati, (2017) who used 50 first-year students as experimental subjects in his study, divided into control classes and experimental classes. In order to measure students'

creative thinking, this paper starts with inquiry learning and surveys the relevant question formation by referring to the fluency, flexibility, and originality of creative thinking. The results show that the inquiry-based teaching class has improved in all three parts, which proves that inquiry-based learning can be used as a learning mode to cultivate creative thinking. In the learning of science curriculum, inquiry-based learning stands as the most fundamental and widely adopted teaching mode, playing a crucial role in fostering students' creative thinking (Meador, 2003; Johnson, 2000 & kind, 2007). Therefore, combined with the research of many scholars, it is determined that this learning pattern is suitable for students of this course and this major. In this study, the inquiry-based learning program promoted the improvement of students' creative thinking ability, and the post-test results of the experimental group were higher than the pre-test results.

Hypothesis 2: After participating in inquiry-based learning program, the experimental group had a higher level of creative thinking than the control group.

The results showed that there was significant difference between the experimental group and the control group, and the experimental group had higher scores than the control group. The results also support the second hypothesis.

The main reason was that students in the experimental group had gain experience in the teaching method based on inquiry-based learning program which different from the control group. The teaching process consisted of five stages. Among them, Engagement and Exploration are two tasks assigned to students before class, so that students can have more time to explore, discover and create. Explanation, Elaboration and Evaluation are completed in class. The theme setting of the whole inquiry-based learning program is relatively new, interesting and difficult. The students in the experimental group may encounter some obstacles and difficulties in the process of practice. But the process is more conducive to broadening the mind. Purnawati et al. (2021) studied improving creative thinking among 49 students in grade 4 in Sleman Private Primary School. Two cycles of classroom research were adopted, and finally, observation and questionnaire were used to collect data. The results show that inquiry-

based learning modes can improve students' creative thinking ability. Oktavia (2019) conducted a study aimed at enhancing the creative thinking ability of Grade X students through a guided inquiry-learning model. The research was conducted in March 2019 among 22 high school students in Grade X. A pre-test and post-test design were employed to assess students' creative thinking ability. Learning materials included lesson plans, student activity sheets, and tools for assessing creative thinking. Additionally, observation sheets were utilized to support data collection and analysis of the implementation of the learning model, student activities, and assessments of creative thinking ability. The study conducted N-Gain analysis to evaluate the improvement of creative thinking ability before and after the tests. The results indicated that the guided inquiry learning model improved students' creative thinking ability, emphasizing the potential of inquiry-based learning in enhancing students' creative thinking ability.

Dewey is the first scholar to propose inquiry-based learning. He believes that the experience of students and the actual participation are the most important in teaching (Dewey, 1938). Therefore, in inquiry-based learning program, students are helped to connect new experiences with previous ones in order to achieve better experiences. In designing inquiry-based learning programs, teachers ensure that the tasks are both challenging and at the same time relevant to real-life meaning. This kind of task setting can not only stimulate students' interest, but also help them apply their classroom knowledge to real situations and improve their problem-solving skills. Lsaksen et al. (2010) believe that creative thinking is a tool that can solve complex problems and improve the ability to solve problems.

Bruner (1960) emphasized the importance of active learning and problem finding. This does not mean that teachers have no role in the classroom; on the contrary, teachers have more responsibilities. In the course of the activity, teachers need to plan, anticipate possible problems, and prepare coping strategies. Before each activity, teachers need to prepare carefully to ensure smooth progress. In the teaching process, teachers should encourage students to think more divergent. Guilford (1950)

identified the concept of divergent thinking as a key aspect of creative thinking. He believes that creative thinking is the ability to solve problems and to think of various ideas to deal with open-ended problems. This expanded thinking can help students explore topics from different perspectives and stimulate their creativity. Through guidance, students' originality in creative thinking ability has been significantly improved. According to experimental results, inquiry-based learning program are more conducive to improving students' creative thinking.

5.5 Implications for practice

The results of this study have important implications for the professional practice of culinary nutrition.

Firstly, inquiry-based learning program can be an effective tool for improving the creative thinking of students majoring in culinary nutrition. Culinary nutrition educators can integrate inquiry-based learning program into the curriculum to stimulate student interest and enhance engagement. By guiding students through practical exercises, they can not only apply theoretical knowledge in practice but also cultivate their creative thinking ability. This teaching style stimulates students' intellectual curiosity and motivation for independent learning, thereby better preparing them for challenges in their careers.

Secondly, inquiry-based learning program can help students create a more relaxed learning atmosphere. This approach motivates students to explore autonomously, formulate their own ideas, and discover solutions through hands-on experience and observation. In the process, students can develop a passion for learning and experience more freedom and autonomy. Teachers can support students' learning and growth by guiding them in choosing topics they are interested in and designing experimental programs. In this open, supportive environment, students can express their ideas, share their findings, and benefit from feedback from peers and teachers. Additionally, this inquiry-based learning program fosters teamwork, allowing learners to collaborate in groups, motivate one another, and achieve shared progress, thus improving their overall educational journey. In this way, students can develop

professional skills and creative thinking in a relaxed and enjoyable atmosphere, increasing their commitment and confidence in their studies.

Finally, inquiry-based learning program can help students develop important skills such as problem-solving, critical thinking, and decision-making. These skills are essential for culinary nutrition students to succeed in their future careers. Through inquiry-based learning program, students encounter complex problems in real program and must gather information and analyze it to develop innovative solutions. This process hones their ability to synthesize knowledge and make informed decisions in uncertain environments. Moreover, this learning style encourages students to question existing knowledge and methods, cultivating their ability to think independently and critically. These skills will not only be beneficial in academic studies but will also help students address challenges and changes in the industry in their future jobs, enabling them to excel in their careers.

5.6 Limitations of the study

Although the results presented in this study are positive, there are some limitations that need to be acknowledged.

The study only examined the short-term impact of inquiry-based learning program on creative thinking, without follow-up testing. Post-testing was conducted for the experimental group and the control group at the end of all teaching activities, but there was no retesting of the subjects in the subsequent period. Therefore, it is not possible to confirm the stability and permanence of inquiry-based learning program in enhancing students' creative thinking. Given that the effects of this learning style may diminish over time or change due to other factors, future research should focus on validating long-term effects to assess the sustained impact of this teaching method on students' creative thinking.

5.7 Recommendations for future research

Based on the findings of this study, several recommendations can be made for future research on the impact of inquiry-based learning program on students' creative thinking.

First, teachers should carefully design the theme to stimulate students' creative thinking. When designing the theme, attention should be paid to cultivating students' creative thinking and tapping their imagination and creativity. Choosing open, abstract topics allows students more space to explore and express their unique insights. Through challenging and inspiring topics, students are guided to think deeply about issues and explore from different perspectives. This helps stimulate students' creativity and encourages them to think outside the box and generate unique ideas and solutions.

Second, encourage students and protect their imagination. In inquiry-based learning program, evaluation is a crucial component. During students' presentations, teachers can assess their mastery of knowledge through students' narratives of their creative thinking thought processes. In the evaluation process, students' interests should be respected, students' creative ideas should be encouraged, students' individual differences should be respected, and their desire to explore and strange ideas should be protected. By encouraging students more, let them experience the sense of achievement in creation and stimulate their intrinsic motivation.

Thirdly, in instructional design, it is important to ensure there is ample time for creation. In the study, it was found that some students rushed to complete tasks because of time constraints. This is because in traditional dough modeling classes in the past, students mostly just need to imitate existing works, which they can make through pictures and other observations. However, inquiry-based learning program takes place in an open and challenging environment where each topic requires creative problem solving and cannot be used to complete one's own finished product through the work of others. Students need to investigate and explore to get ideas, and draw their own design, according to the design of the finished product. This process can be abstract and difficult. In order for students to display their creativity more effectively,

teachers should provide sufficient time according to students' needs. This can be achieved by appropriately extending class hours or setting up unfinished work areas so that students can participate in learning and continue to create at any time.

Fourthly, it is found in this study that with the improvement of the originality of students' works, their fluency has not reached the level it should be. This is because in the process of creative thinking development, it is difficult for students to generate multiple ideas in a short time. This highlights the challenge of promoting originality and fluency. It is suggested that attention be paid to balancing the two in teaching to promote students' ability to generate a large number of ideas quickly while developing unique perspectives and creating novel ideas.

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APPENDIX

APPENDIX 1

Creative Thinking Test

Name…….. Age……

Hello, classmates! Please read the following requirements carefully before answering, fully cooperate with the command of the tester during the answering process, and answer carefully within the scope of time. Thank you for your participation. Thank you!

Requirement:

1. Strive to generate as many ideas as possible.
2. Add details to your ideas so that each drawing tells a complete and interesting story.
3. If you have finished your answer within the allotted time, you can continue to add details to your drawing, or sit quietly in your seat, don't move around or make noise.
4. After answering the question, do not rush to do the next one, please wait unified instruction before starting.

Activity 1: Build the picture

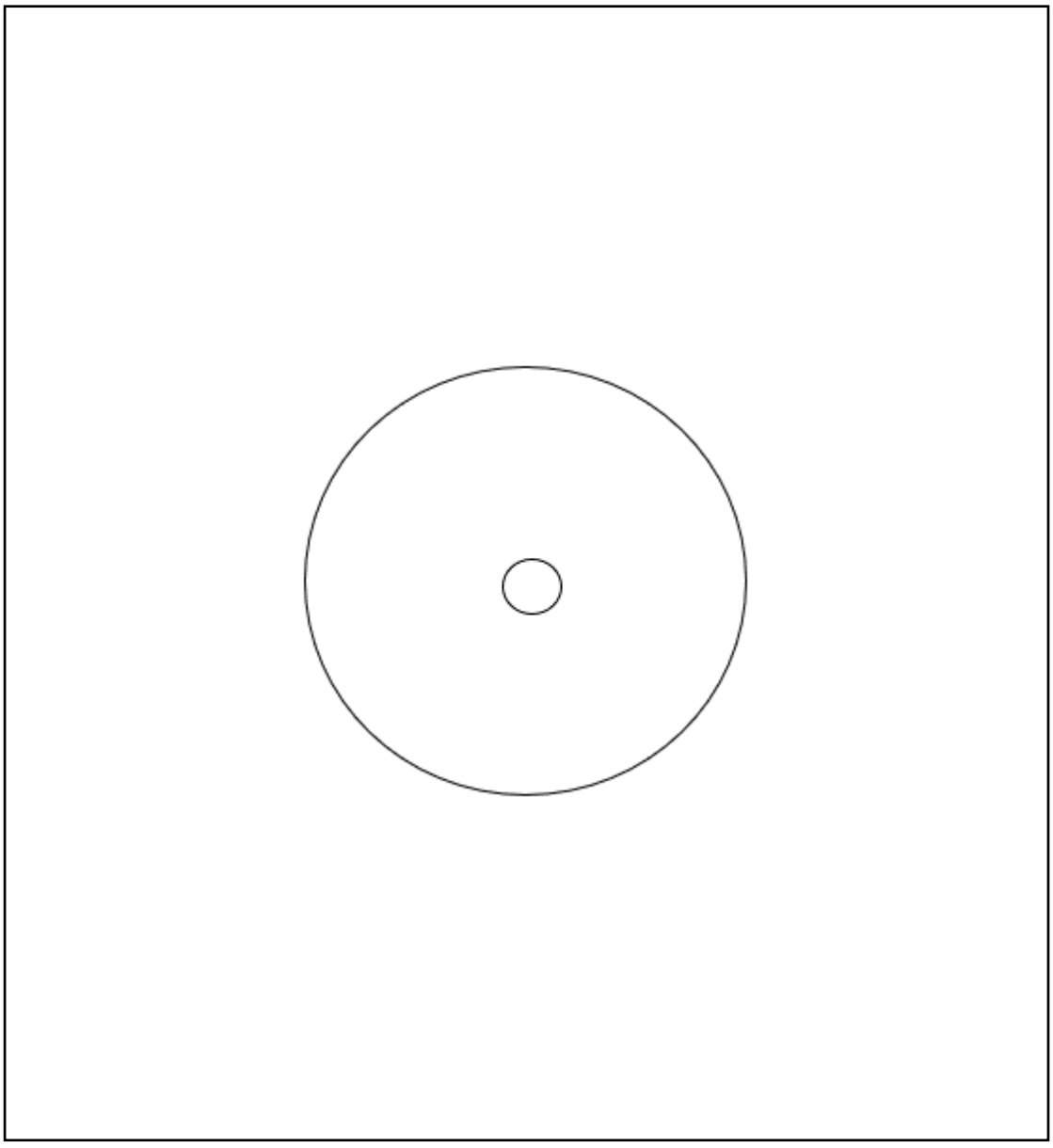
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

11.

12.

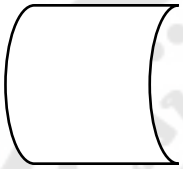
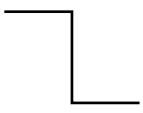
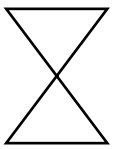
13.

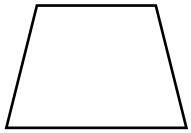
According to the figure, you will see the figure as specified in the frame. Please add the figure given to be something new, most interesting, and exciting. You will have ten minutes to complete the activity.



Activity 2: Complete the pictures

Here are 10 unfinished paintings, what do you think of when you look at them? Please show your ideas by adding the patterns given. Try to come up with some unique ideas to complete these paintings. To make your paintings more interesting and exciting, you can add more details. You will have ten minutes to finish the task.

1. 	2. 
3. 	4. 
5. 	6. 

7. 	8. 
9. 	10. 

Activity 3: Draw a line

There are 30 patterns below. Please add the patterns given to be something new, most interesting, and exciting. Try to think of different things, make sure that each pattern is different, and provide more details to make your idea more complete and show the interesting story. The test time for this activity is 10 minutes.

1. 	2. 	3. 
4. 	5. 	6. 
7. 	8. 	9. 

10. 	11. 	12. 
13. 	14. 	15. 
16. 	17. 	18. 
19. 	20. 	21. 

22. 	23. 	24. 
25. 	26. 	27. 
28. 	29. 	30. 

APPENDIX 2

Design for Inquiry-Based Learning program

Definition of Inquiry-Based learning

Inquiry-based learning is a student-centered constructivist teaching method that combines theory and practice. This method mainly cultivates students' advanced thinking and independent learning ability. Students need to participate in the learning process actively, learn to identify problems, think deeply, and build their knowledge in the process of inquiry.

In this study, inquiry-based learning aims to create a more positive learning environment for students, enabling them to acquire new skills and knowledge. In this learning environment, students can be inspired by creative thinking through independent practice.

This study will use the self-designed inquiry-based learning program as an experimental tool for inquiry-based learning. The program consists of four parts: classroom-learning objectives, teaching key and difficult points, learning tools, teaching steps (5E Instructional Model).

Structure of Inquiry-based learning program

Activity theme	Step	Task	Components of creative thinking
Activity 1 Introduction Post the next class assignment: Activity 2.The Strangest Pumpkin (Homework)	Introduce the course、Give out Creative Thinking Test	Understand the course content、Complete the Creative Thinking Test	
	Step1 Engagement	Release Inquiry-based Learning Program 1.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 1.1. For example, they might draw pumpkin Superman, or even a pumpkin mummy that doesn't rot.	
Activity 2 The Strangest Pumpkin (Students work alone) (Classroom)	Step3 Explanation	Students introduce their design, including details such as its name and the creative elements introduced into the design. Teacher demonstrates basic shapes.	Originality Elaboration
	Step4 Elaboration	Students use dough modeling to create their own designs.	
	Step5	Students show their works in turn	

	Evaluation	and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 3. A Magical Enchanted Tree(Homework)	Step1 Engagement	Release Inquiry-based Learning Program 2.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 2.1. For example, a student might create a piece depicting a magical tree monster that swallows humans.	
Activity 3.A Magical Enchanted Tree (Students work alone) (Classroom)	Step3 Explanation	Students choose their most creative magic tree design, present the design in class, and introduce their own work. Teacher demonstration tree basic production requirements.	Originality Elaboration
	Step4 Elaboration	Students use dough modeling to create their own designs.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 4. Never-fading rose/ withered rose (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 3.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the	

		Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 3.1. They might envision an exquisite knife adorned with beautiful rose decorations, radiating dazzling brilliance, resembling a rose amidst life's thorns.	
Activity 4. Never-fading rose/ withered rose (10 people for each topic. Work alone) (Classroom)	Step3 Explanation	Students choose their most creative rose design, present the design in class, and introduce their own work. The teacher demonstrated making rose petals.	Originality Elaboration
	Step4 Elaboration	Students use dough modeling to create their own designs.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 5. Monster Appearance (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 4.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 4.1. For	

		example, they may imagine a monster with five eyes, iridescent scales, and a body covered in bizarre knots, nicknamed the pimple.	
Activity 5. Monster Appearance (Students work alone) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students use dough modeling to create their own designs.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 6. A flying rabbit (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 5.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 5.1. Maybe the students drew a rabbit with rainbow ears, each color representing a different ability to fly. Red ears may allow it to fly faster, while blue ears allow it to spin in mid-air.	

Activity 6. A flying rabbit (Students work alone) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students use dough modeling to create their own designs.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 7. World Noodle Beauty Pageant (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 6.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 6.1. For example, they might design noodles in various unique forms, such as heart-shaped or animal-shaped, or adorn noodles with decorations like flowers, smiley faces, and more.	
Activity 7. World Noodle Beauty Pageant (A group of 2 people) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	

	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 8. Cat known as the Master Chef (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 7.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 7.1. For example, they might design cat-made treats, such as cat's claw creme fraiche, fish cat's claw chocolate, chicken leg flavored cat's claw candy, etc.	
Activity 8. Cat known as the Master Chef (A group of 2-3 people) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 9. The Gift	Step1 Engagement	Release Inquiry-based Learning Program 8.1 to students.	Fluency Originality

for Totoro (Homework)	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 8.1. For example, they might design a gift for the Totoro, such as a Totoro bouquet decorated with colorful flowers, or a box of beautifully made Totoro chocolates.	Elaboration
Activity 9. The Gift for Totoro (A group of 4 people) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 10. Doraemon's Most Desired Destination (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 9.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-	

		based Learning Program 9.1.	
Activity 10. Doraemon's Most Desired Destination (A group of 5 people) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment: Activity 11. Mr. Pig's Sunshine Party (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 10.1 to students.	Fluency Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 10.1.	
Activity 11. Mr. Pig's Sunshine Party (A group of 5 people) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	

Post the next class assignment: Activity 12. My Dream Cottage (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 11.1 to students.	Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 11.1.	
Activity 12. My Dream Cottage (A group of 10 people) (Classroom)	Step3 Explanation	Students choose their most creative designs, present the designs in class, and introduce their own work.	Originality Elaboration
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Post the next class assignment Activity 13.The Happiest Dinner Moments (Homework)	Step1 Engagement	Release Inquiry-based Learning Program 12.1 to students.	Originality Elaboration
	Step2 Exploration	Students generate creative ideas by reading picture books, searching the Internet, or searching for information from the surrounding environment, and draw their ideas in the Inquiry-based Learning Program 12.1.	
Activity 13.The Happiest Dinner Moments	Step3 Explanation	Students choose their most creative designs, present the designs in	Originality Elaboration

(A group of 10 people) (Classroom)		class, and introduce their own work.	
	Step4 Elaboration	Students used dough modeling to create their own designs into a 3D piece.	
	Step5 Evaluation	Students show their works in turn and conduct mutual evaluation between teachers and students.	
Activity 14 Conclusion	Send the test again.	Students complete the post-test.	

Inquiry-based learning program 1

<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>The Strangest Pumpkin</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Understand the basic process of dough modeling production.
(2) Can express their ideas with dough modeling works.
(3) Be able to describe their feelings in words and experience the joy of creation in activities.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
The pumpkin shape designed by students can show unique creativity.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teacher publishes task document Inquiry-based Learning Program 1.1, read the instructions in the task document. Having the students identify the theme of the activity as "the strangest pumpkin" triggers a prior knowledge that students may have in mind some common pumpkins in everyday life, or some strange pumpkins they have seen. Second, inform the students of the task</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 1.1 and clarify the activity requirements.</td></tr>
</table>

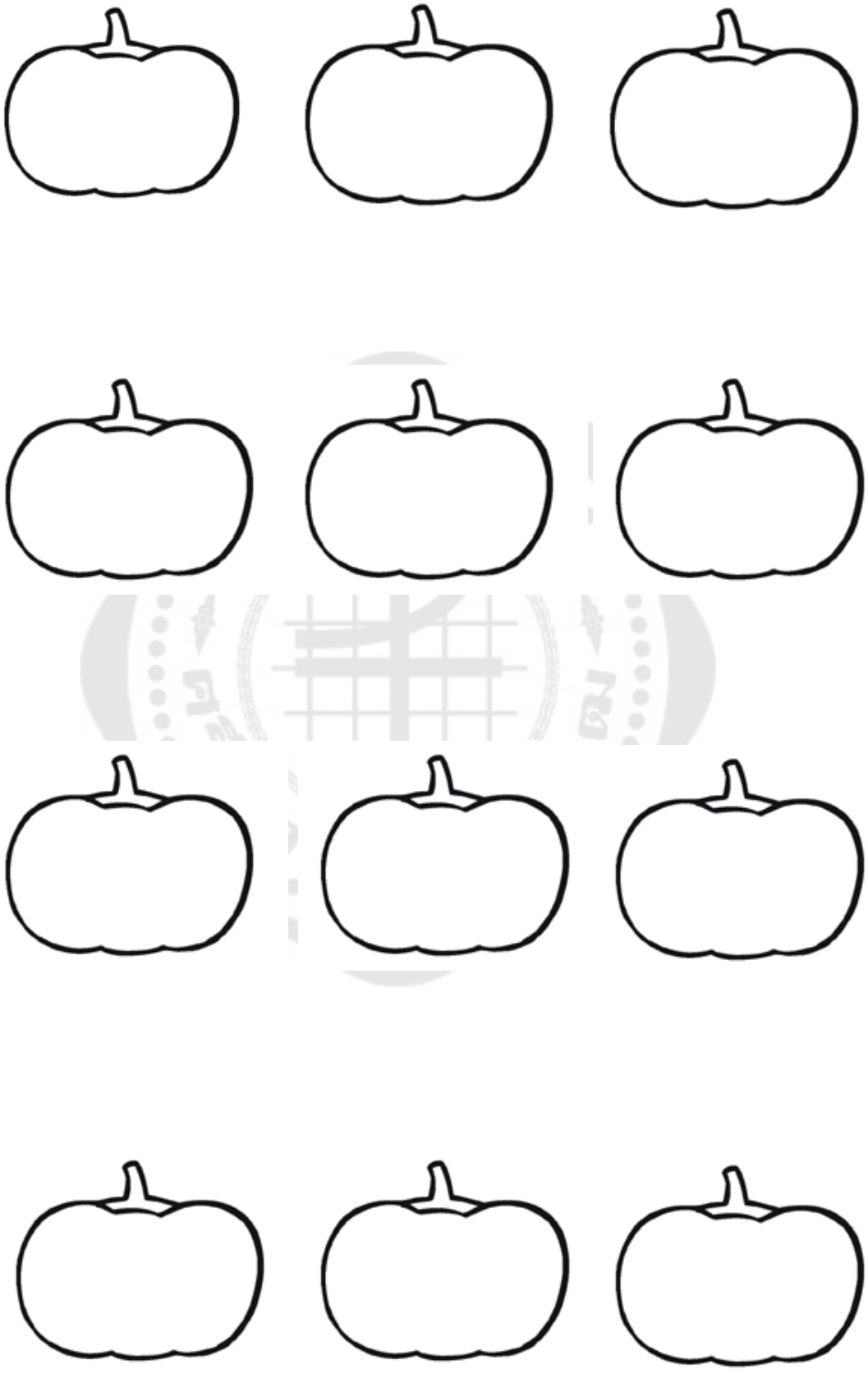
	requirements. Use the information in the instructions to promote curiosity and get students thinking about what kind of pumpkins they can create that are both strange and not seen in everyday life.	
Step2 Exploration (Homework)	Provide students with ways to explore, such as reading picture books, searching the Internet, or searching for information from the surrounding environment to generate creative ideas. Additionally, use examples to inspire students' imagination, like explaining the intriguing concept of combining a pumpkin and a teapot, resulting in a whimsical "Teapot Pumpkin."	Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 1.1. For example, they may use everyday items to design pumpkins, such as a pumpkin robot, a pumpkin street lamp, or even a non-decaying pumpkin mummy, which might be considered strange.
Step3 Explanation (Classroom)	Ask students to describe the strangest pumpkin they've designed, including details such as its name, appearance, features, and creative elements introduced into the design.	In the design draft of their Inquiry-based learning program 1.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.

	The teacher explained and demonstrated the basic shape of the pumpkin, so as to develop the basic shape of the production skills. For example, the basic shape of circle, heart, strip, oval and its basic shape of making flakes.	Students watch the teacher's demonstration to accumulate basic knowledge. After mastering the production of the basic shape, you can gradually make other shapes through the basic shape.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough-modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity. For example, when making the mud, it was found that it was not smooth enough and easy to crack, or when making it, it was impossible to fully reproduce the painting by itself, which required relatively high imagination.

Inquiry-based learning program 1.1

Name: Creation theme: The Strangest Pumpkin

What do you think the strangest pumpkin might look like? With many heads? Alternatively, it can shine at night, like a shining star. Alternatively, it can be transparent, and you can see the seeds and textures inside, just like glass. Here are 12 basic pumpkin shapes. Show your imagination according to the theme, create a strange and creative pumpkin that people have never seen in everyday life, and provide more details for your pumpkin, such as the spots on the surface of the pumpkin, the vine man, its leaf texture, etc. Finally, please select the best one from the 12 activity design drawings for the creation of this activity. If you have more than 12 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. Print this design before you start drawing, and at the end of each class, post your finished work on the classroom wall to show off your unique creativity.



Inquiry-based learning program 2

<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>A magical enchanted tree</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Based on the tree, add some simple objects through association and present the main characteristics of the tree.
(2) Be able to use imagination to express their ideas.
(3) Can be meticulous and patient to make the tree further.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Tree detail making</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teachers publish task document Inquiry-based Learning Program 2.1, read the instructions in the task document. Having students identify the theme of the activity as "a magical magical tree" can trigger prior knowledge that students may have some magical tree in mind that they have seen on TV. Second, inform the students of the task requirements. Use the</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 2.1 and clarify the activity requirements.</td></tr>
</table>

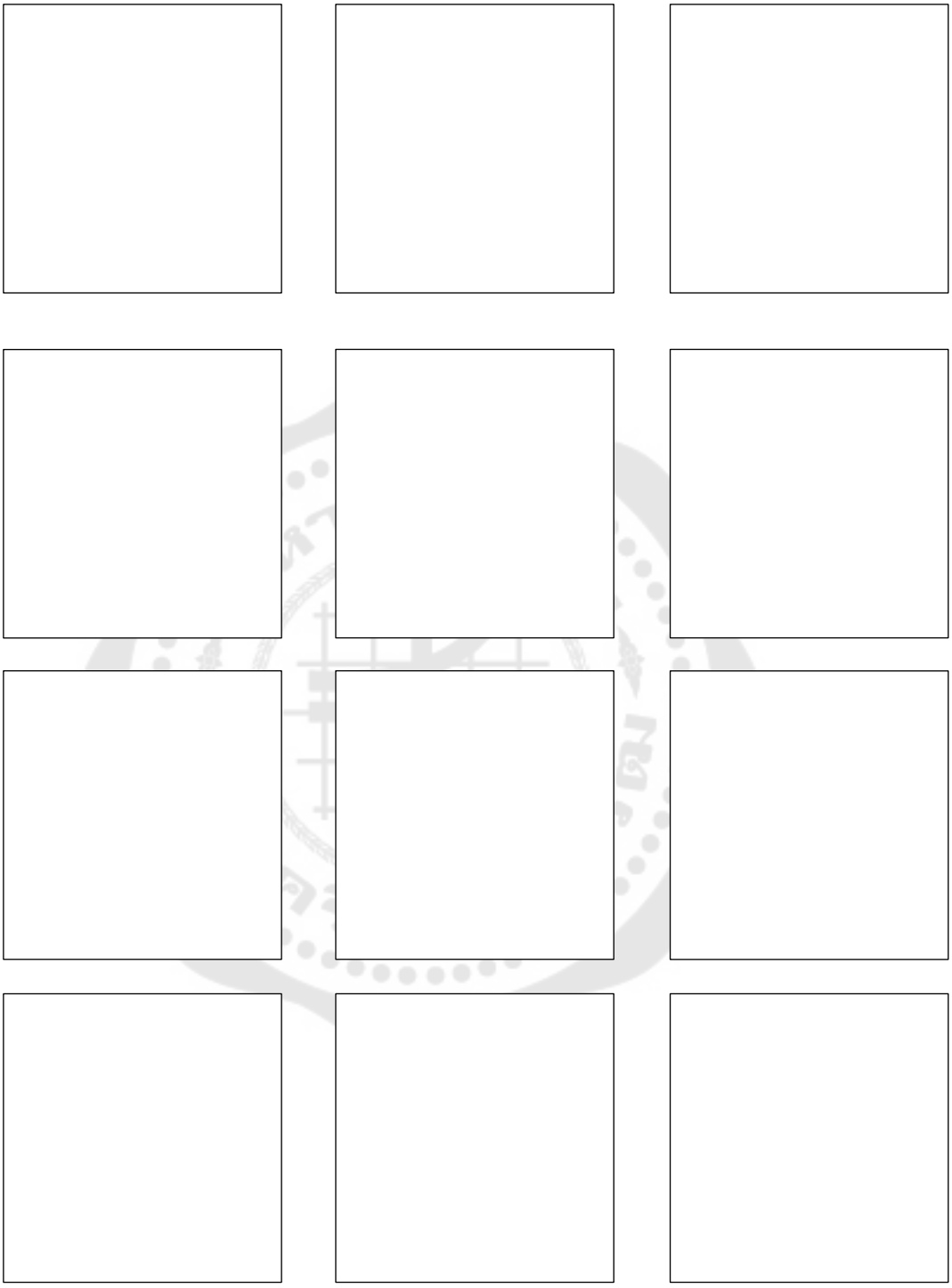
	information in the instructions to promote curiosity and get students thinking about what characteristics the magic tree should have and what special magic they would give it.	
Step2 Exploration (Homework)	Provide students with ways to explore, such as reading picture books, searching the Internet, or searching for information from the surrounding environment to generate creative ideas. It is also possible to stimulate the imagination of students through examples, for example, telling students about a magical tree whose leaves may be various colors instead of the traditional green. This tree has a unique mystical rune with powerful abilities.	Students generate ideas after independent exploration and draw their ideas in the Inquiry Learning Program 2.1. For example, a student might take inspiration from a fairy tale storyteller who finds trees in everyday life and imagine the shape of a magical tree, which might be a magical tree monster that swallows humans, or a mysterious tree with the power to heal the earth.
Step3 Explanation (Classroom)	Ask students to introduce their magic tree design, including details such as its name, features of its appearance, what special powers it possesses, and the creative elements introduced in the design.	In the design draft of their Inquiry-based learning program 2.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.

	The teacher explained the basic knowledge of tree making, such as the making of the trunk, how the trunk can be supported and held in place without collapsing, and the tools needed to use.	Students watch the teacher's demonstration to accumulate basic knowledge. After mastering the production of the basic shape, you can gradually make other shapes through the basic shape..
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity. For example, most students may not use tools to make the shape of a tree, for example, they will not reasonably distribute and adjust the wire when twisting it into a trunk.

Inquiry-based learning program 2.1

Name: Creation theme: A magical enchanted tree

Please close your eyes and imagine a magical tree. Imagine what it looks like, where it grew, its environment, and the special abilities it might have. Try to imagine as much detail as possible about the tree, the texture of the leaves, the lines of the trunk, and the surrounding landscape. Please draw your ideas in the 16 blank forms below, each idea must not be repeated, it must be something new, unique and creative. Finally, please select the best one from the 16 activity design drawings for the creation of this activity. If you have more than 16 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. Before you start drawing, print out this draft and post it on the classroom wall at the end of each class.



Inquiry-based learning program 3

<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>1. Never-fading rose 2. withered rose</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Know how to make roses
(2) Can boldly carry out the creative design of roses and stimulate students' curiosity.
(3) Generate interest in discovery and exploration in life.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students are able to come up with creative works</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teacher publishes task document Inquiry-based Learning Program 3.1, read the instructions in the task document. Using the method of drawing lots, the 20 students were evenly divided into two groups, one group with the theme "Never-fading rose" and the other group with the theme "withered rose".</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 3.1 and clarify the activity requirements.</td></tr>
</table>

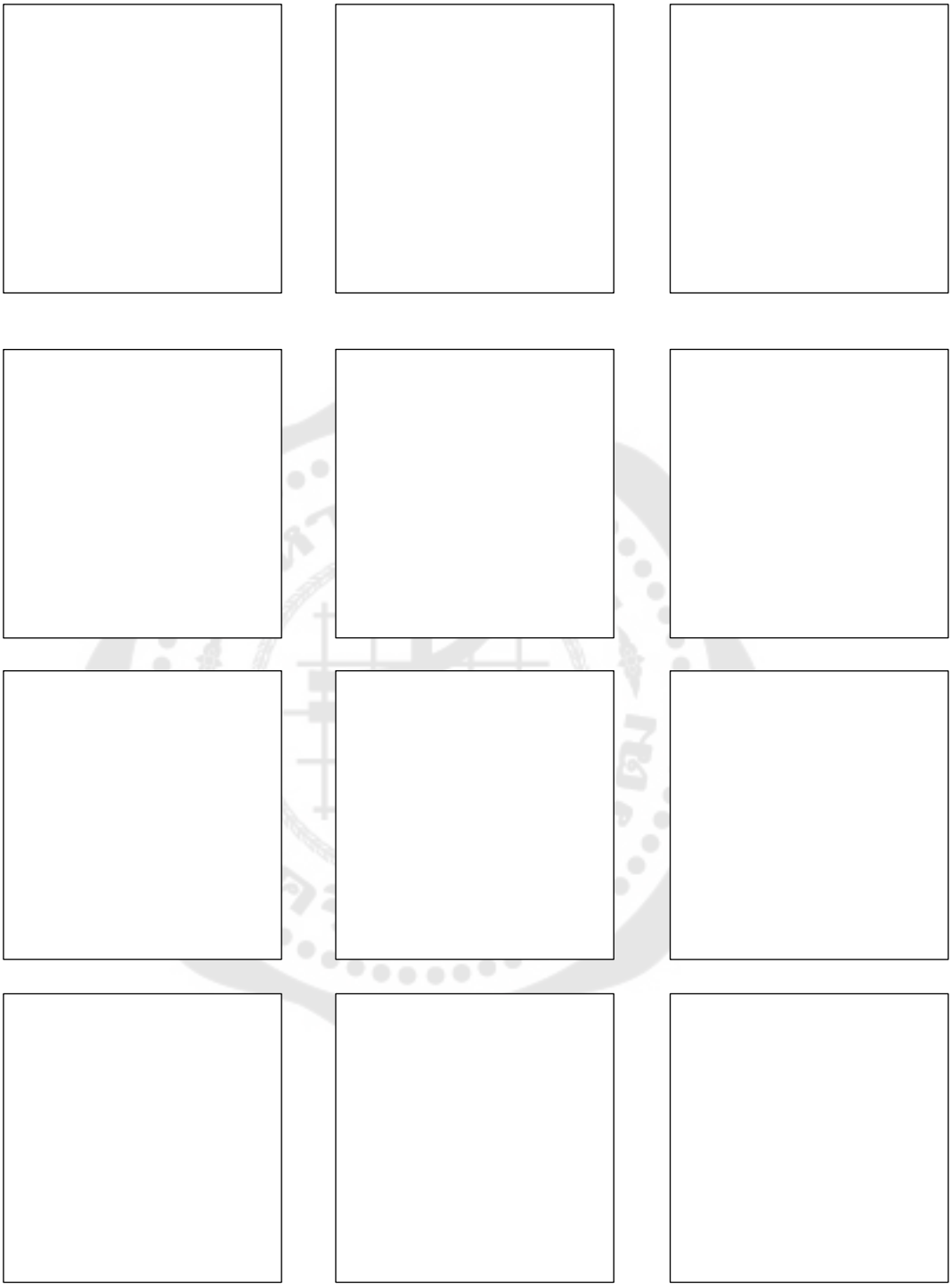
Step2 Exploration (Homework)	Provide students with ways to explore, such as reading picture books, searching the Internet, or searching for information from the surrounding environment to generate creative ideas. Students' imaginations can also be stimulated by examples. For example, tell students that an eternal rose can be made into a beautiful rose necklace or rose ring, so as to reflect the characteristics of the rose will never fade. Let the students take the rose as the main body and expand their imagination to highlight the characteristics of never fading and wilting respectively.	Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 3.1. They might envision an exquisite knife adorned with beautiful rose decorations, radiating dazzling brilliance, resembling a rose amidst life's thorns.
Step3 Explanation (Classroom)	Have students introduce the rose they have designed, including details such as its name, its appearance features, and the creative elements introduced in the design.	In the design draft of their Inquiry-based learning program 3.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.

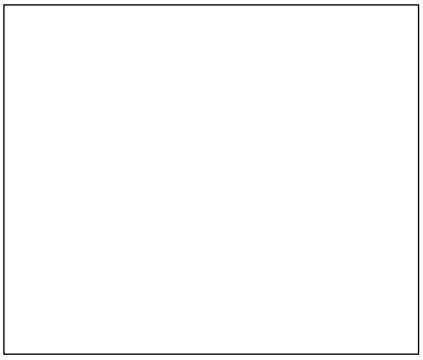
	Teachers demonstrate how to make rose petals, so that students can master the basic skills.	Students watch the teacher's demonstration to accumulate basic knowledge. After mastering the production of the basic shape, you can gradually make other shapes through the basic shape.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

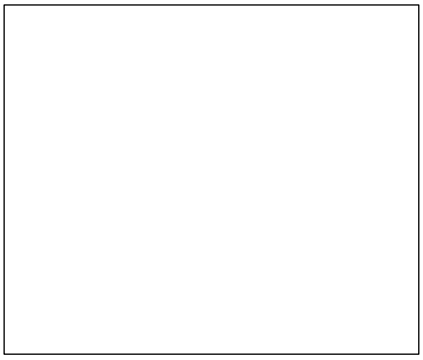
Inquiry-based learning program 3.1

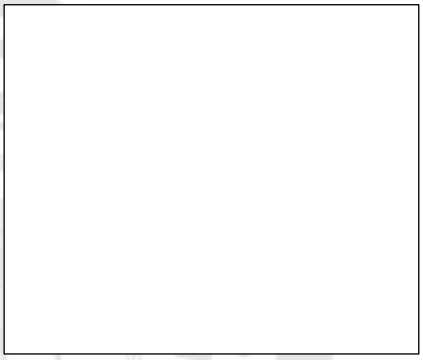
Name: Creation theme: 1. Never-fading rose 2.Withered rose

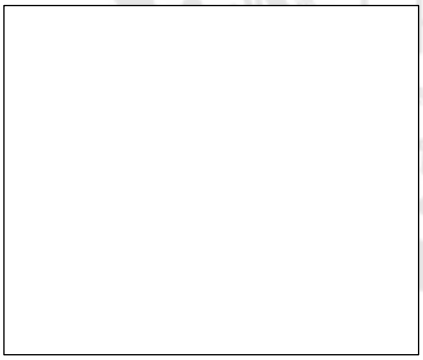
Please decide on your theme first and expand your imagination according to the theme. Like the rose that never dies, if a jewelry designer, she may have created a jewel rose ring that represents eternal value and beauty. So, how would you embody the character of never dying? This prompt will inspire you to create as many unique and creative rose works as possible. Describe your idea with more details, such as the petals' texture details and the leaves' details. Please draw your design in the 20 blank forms provided below. If you have more than 20 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. This design draft can be used as your activity guide, you need to choose the best design to create the dough modeling works of this activity. Before you start drawing, print out this blank design and post the finished design on the classroom wall at the end of each class.

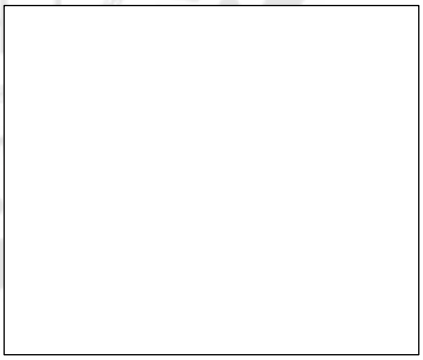


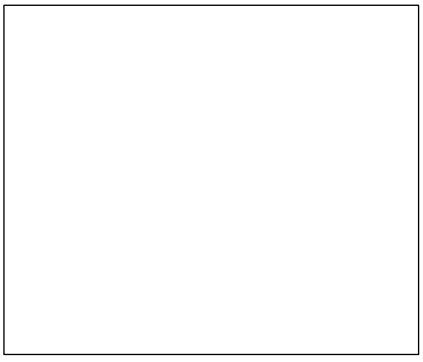


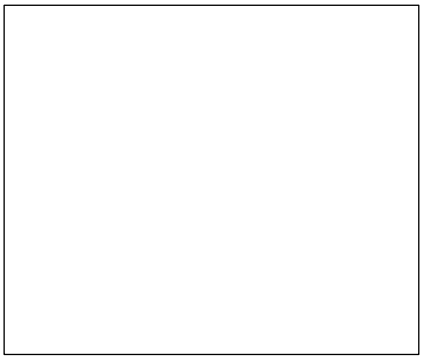












Inquiry-based learning program 4

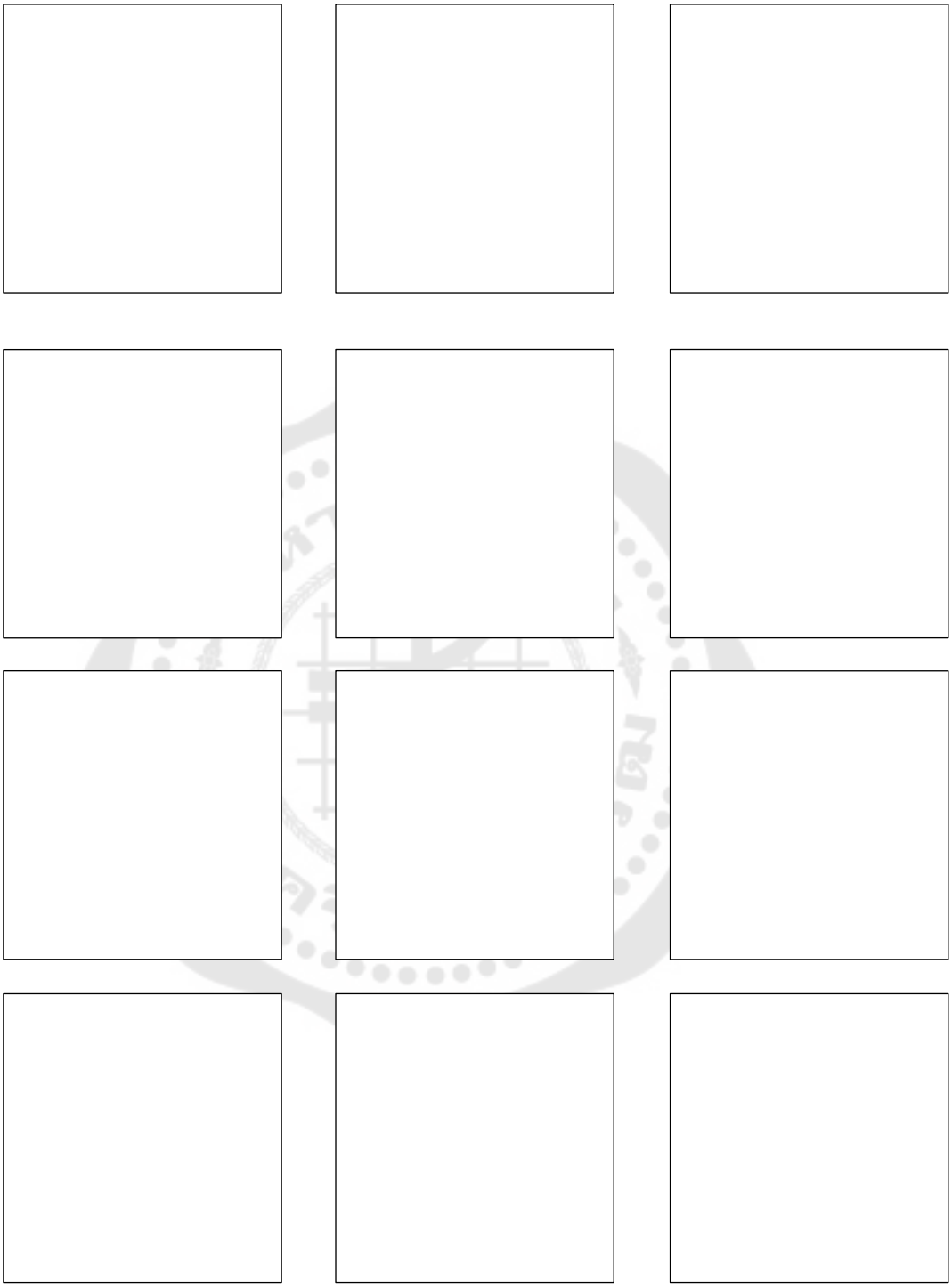
<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>Monster Appearance</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) The collision of ideas brought by the perception of dough modeling.
(2) Expand the content of the theme and present it with dough modeling works.
(3) Develop students' imagination by imagining based on previous experience.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students can create creative works.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teacher publishes task document Inquiry-based Learning Program 4.1, read the instructions in the task document. Through the information in the instruction to stimulate the imagination of students, let students imagine a monster according to the theme, give the monster various abilities, and use colors and details to show the ability of the monster.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 4.1 and clarify the activity requirements.</td></tr>
</table>

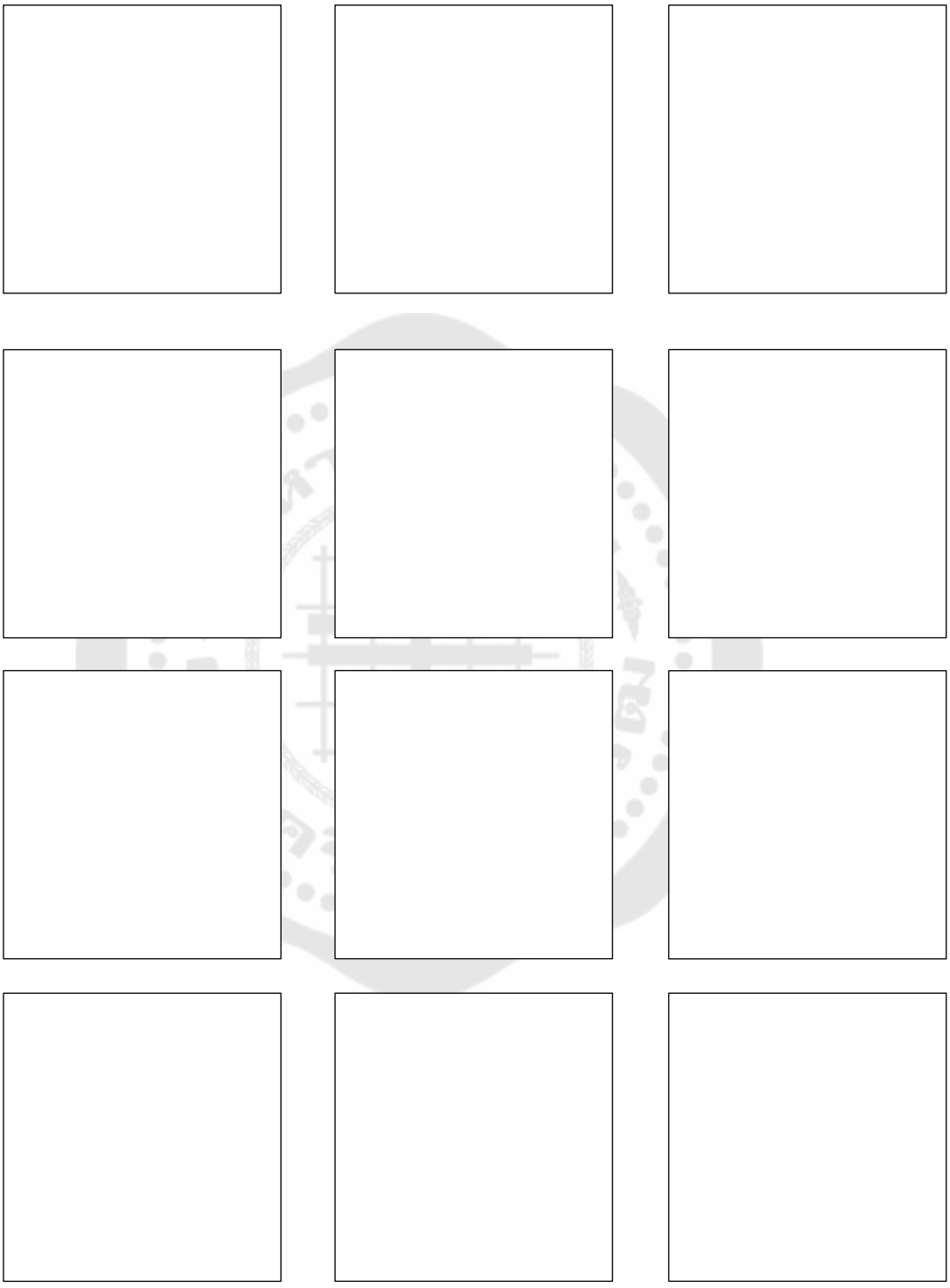
Step2 Exploration (Homework)	Provide students with ways to explore, such as reading picture books, searching the Internet, or searching for information from the surrounding environment to generate creative ideas.	Students generate ideas through independent exploration and draw their ide Inquiry-based Learning Program as in 4.1. For example, they may imagine a monster with five eyes, iridescent scales, and a body covered in bizarre knots, nicknamed the pimple.
Step3 Explanation (Classroom)	Have students introduce their monster design, including the monster's name, physical characteristics, the abilities it possesses, and explain the creative meaning behind their work.	In the design draft of their Inquiry-based learning program 4.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough-modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

Inquiry-based learning program 4.1

Name: Creation theme: Monster Appearance

Create, based on the given theme, an imaginary monster that no one has ever seen before. This creature possesses unique abilities that, upon its appearance, might bring disasters, causing fear among people. Conversely, it could also bring good fortune, making it highly admired. Use colors, intricate details, and other physical characteristics to depict the monster's abilities. Please draw your imaginary monster in the 24 blank forms below, and choose the best monster design from them, and shape the monster by hand through dough plasticity. If you have more than 24 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. This is the design for your activity. Please print it out before painting. Post your design on the classroom wall after the class.





Inquiry-based learning program 5

<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>A flying rabbit</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) The collision of ideas brought by the perception of dough modeling.
(2) Expand the content of the theme and present it with dough modeling works.
(3) The joy of encountering intellectual collisions through exploration in both the classroom and everyday life, enhancing the classroom's level of interest.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students can create creative works.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teacher publishes the task document for Inquiry-based Learning Program 5.1. Firstly, have students define the theme of the activity as "A flying rabbit," tapping into their prior knowledge where they may envision the appearance of a flying rabbit in their minds. Secondly, instruct students to read the task document guidelines, informing them of the task requirements. Utilize the information in the instructions to</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 5.1 and clarify the activity requirements.</td></tr>
</table>

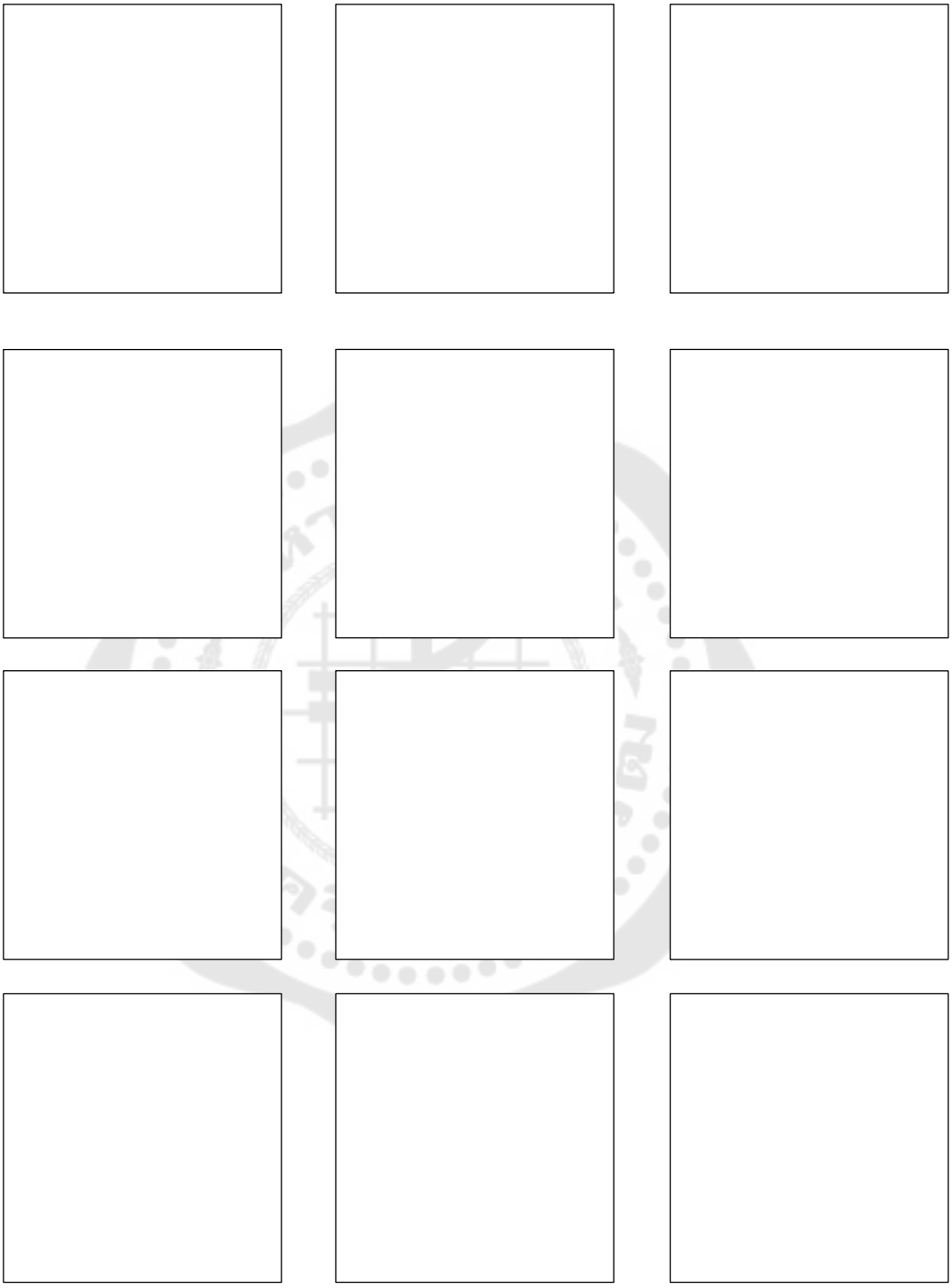
	stimulate students' imagination.	
Step2 Exploration (Homework)	Students are encouraged to generate creative ideas by reading picture books, searching the Internet, or exploring from their surroundings. Students' imaginations can also be stimulated by examples. For example, teach students that a rabbit may have particularly large ears, which allows it to fly, or that it may have colorful wings and a flexible body, which allows it to fly more flexibly.	Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 5.1.Perhaps the students imagine a rabbit with rainbow ears, where each color represents a different flying ability; for instance, red ears might make it fly faster, while blue ears allow for mid-air spinning.
Step3 Explanation (Classroom)	Let students to introduce their designed "A flying rabbit," including its name, physical features, abilities, and an explanation of the creative idea behind the artwork.	In the design draft of their Inquiry-based learning program 5.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.

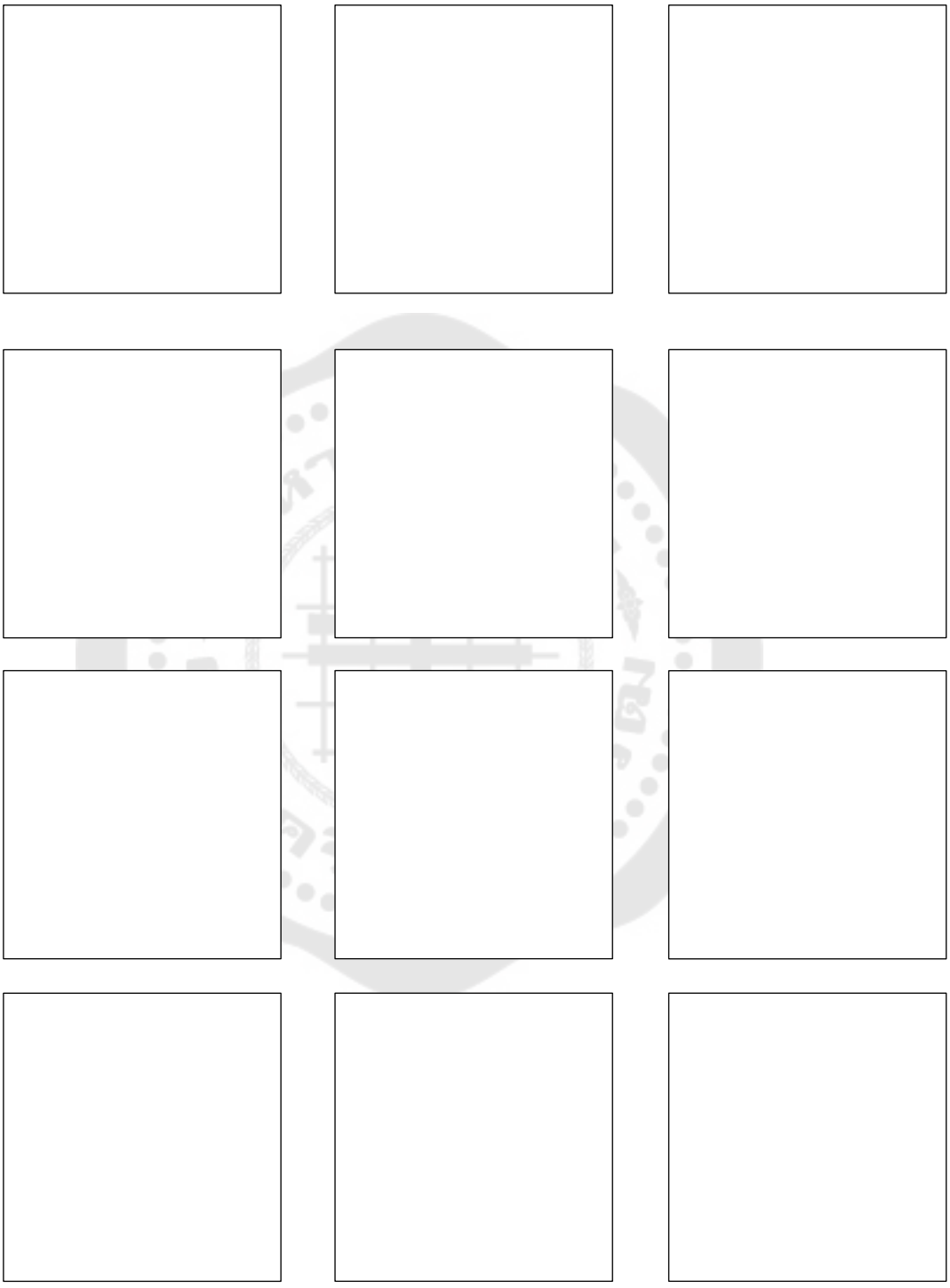
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

Inquiry-based learning program 5.1

Name: Creation theme: A flying rabbit

What do you think a flying rabbit would look like? What characteristics and abilities might it have? Perhaps it would be covered in soft, lightweight feathers to aid its flight, or maybe it would possess a structure resembling bat wings? Please use your imagination and creativity to create an eye-catching piece of art. There are 28 blank squares below, please sketch 28 different forms of flying rabbits, ensuring to portray their differences with intricate details. Choose the most outstanding design from these 28 sketches and make it. Finally, please select the best one from the 28 activity design drawings for the creation of this activity. If you have more than 28 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. This document serves as the design draft for the activity; please print it before starting your artwork. At the end of the class, display your chosen design on the classroom exhibition wall.





Inquiry-based learning program 6

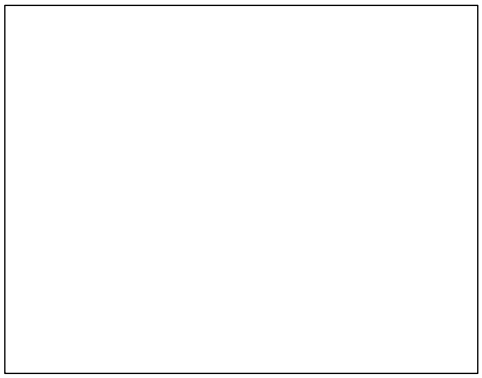
<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>World Noodle Beauty Pageant</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Students develop a rich imagination through the theme, understand the characteristics of the lines, the types of noodles.
(2) Assist students in broadening their thinking, experiencing the novelty within the curriculum, and finding joy in creative expression throughout the course.
(3) Develop students' interest in discovering and exploring in their daily lives.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students can create creative works.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teacher publishes task document Inquiry-based Learning Program 6.1, read the instructions in the task document.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 6.1 and clarify the activity requirements.</td></tr>
<tr><td>Step2 Exploration (Homework)</td><td colspan="2">Students are encouraged to explore and generate creative ideas by reading picture books, researching online, and observing various forms of noodles in</td><td>Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 6.1. For example, they might</td></tr>
</table>

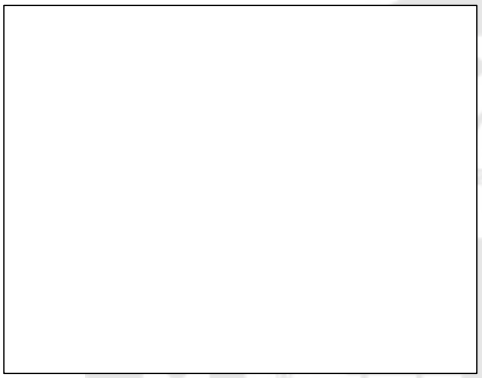
	daily life.	design noodles in various unique forms, such as heart-shaped or animal-shaped, or adorn noodles with decorations like flowers, smiley faces, and more.
Step3 Explanation (Classroom)	Ask students to introduce their own design, including the name of the work, physical features and details such as the creativity behind the work and the creative elements added to the design.	In the design draft of their Inquiry-based learning program 6.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

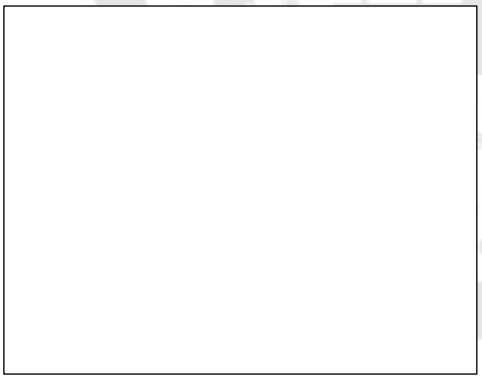
Inquiry-based learning program 6.1

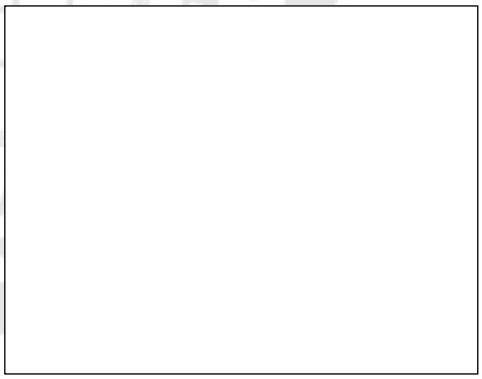
Name: Creation theme: World Noodle Beauty Pageant

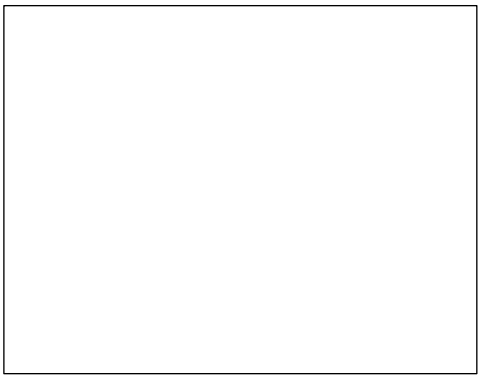
The Noodle Kingdom is about to host a World Noodle Beauty Pageant, which will be a grand event brimming with global noodle diversity and cultural exchange! Noodles representing various parts of the world will come together for this grand event. The selected noodle will be honored with the title "Ultimate Noodle King." Each noodle is showcasing its unique charm—ramen is dancing a tap dance, instant noodles got a fancy big wave hairstyle at the salon, and tomato pasta is adorned in a sparkling red gown. Every noodle is preparing for this beauty feast in its own way, aspiring to claim the spotlight on stage! Please unleash your imagination and draw the most beautiful noodles in your mind in the 32 blank spaces provided. You can illustrate different types or styles of noodles from various countries such as Italian pasta, Chinese noodles, Japanese ramen, Mexican corn noodles, etc. Each noodle can have distinctive features and decorations, like shape, color, toppings, or special styling. Use rich details and vibrant colors to make each noodle character vivid and unique. Consider designing personalized expressions, attire, hairstyles, or even surrounding decorations for the noodles to showcase their personality and charm. This activity requires the cooperation of a team of two. Finally, please choose the most creative one from the 32 activity design drawings for the creation of this activity, and create 3D three-dimensional works according to your design. If you have more than 32 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. This is your activity plan; please print it out before drawing and display your design after each class on the classroom wall.

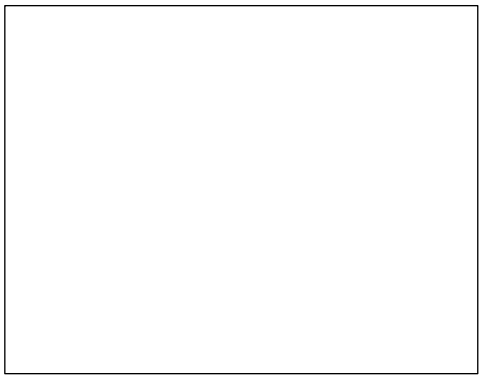


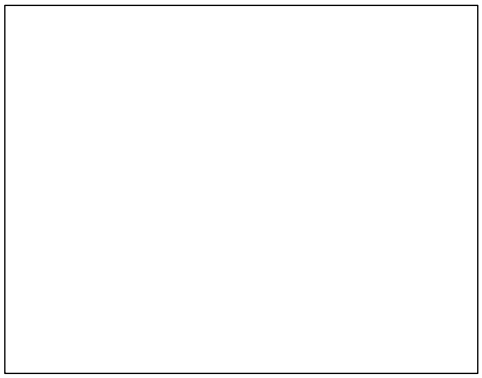


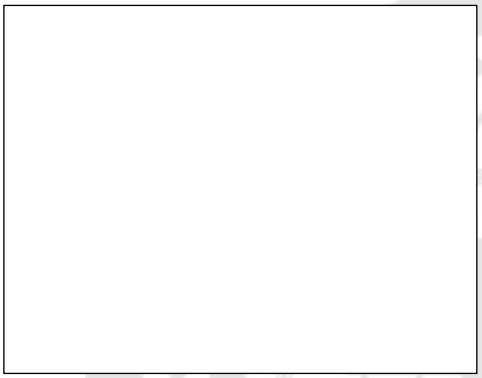


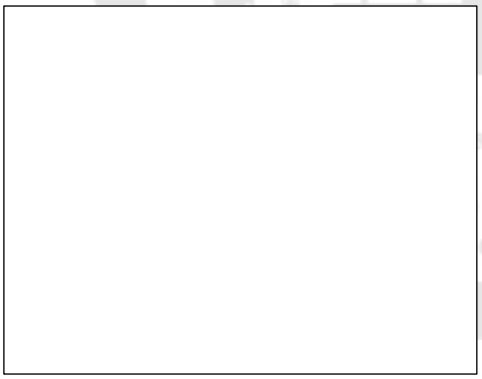


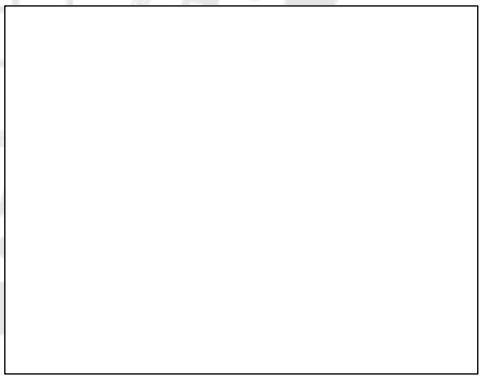


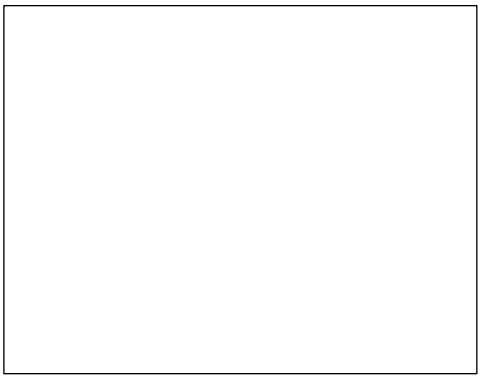


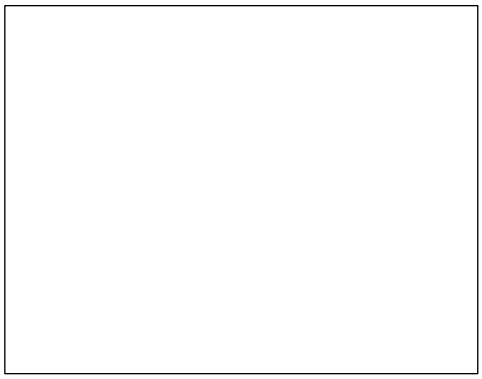


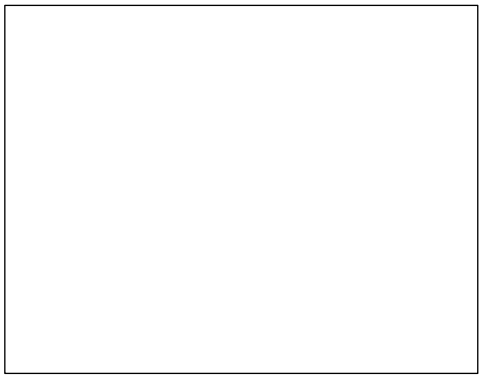


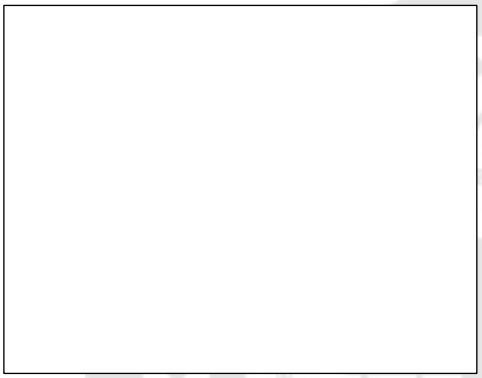


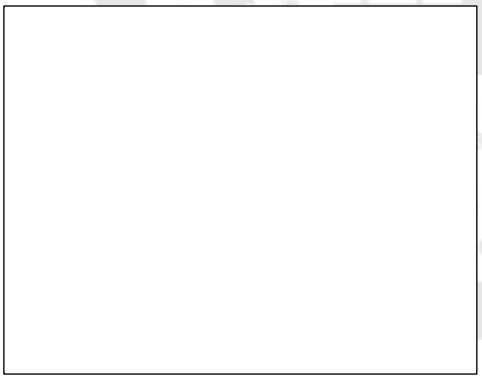


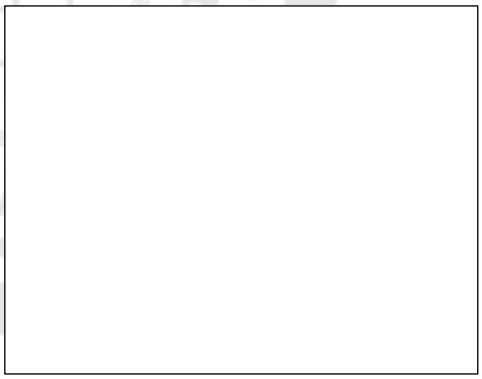


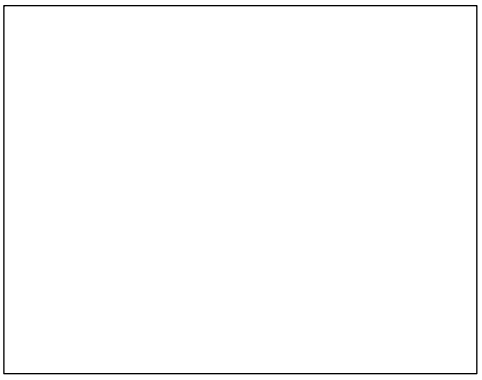


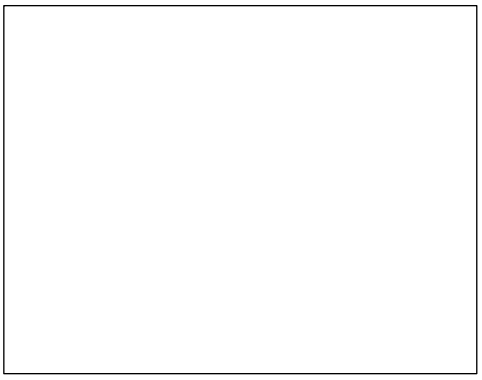












Inquiry-based learning program 7

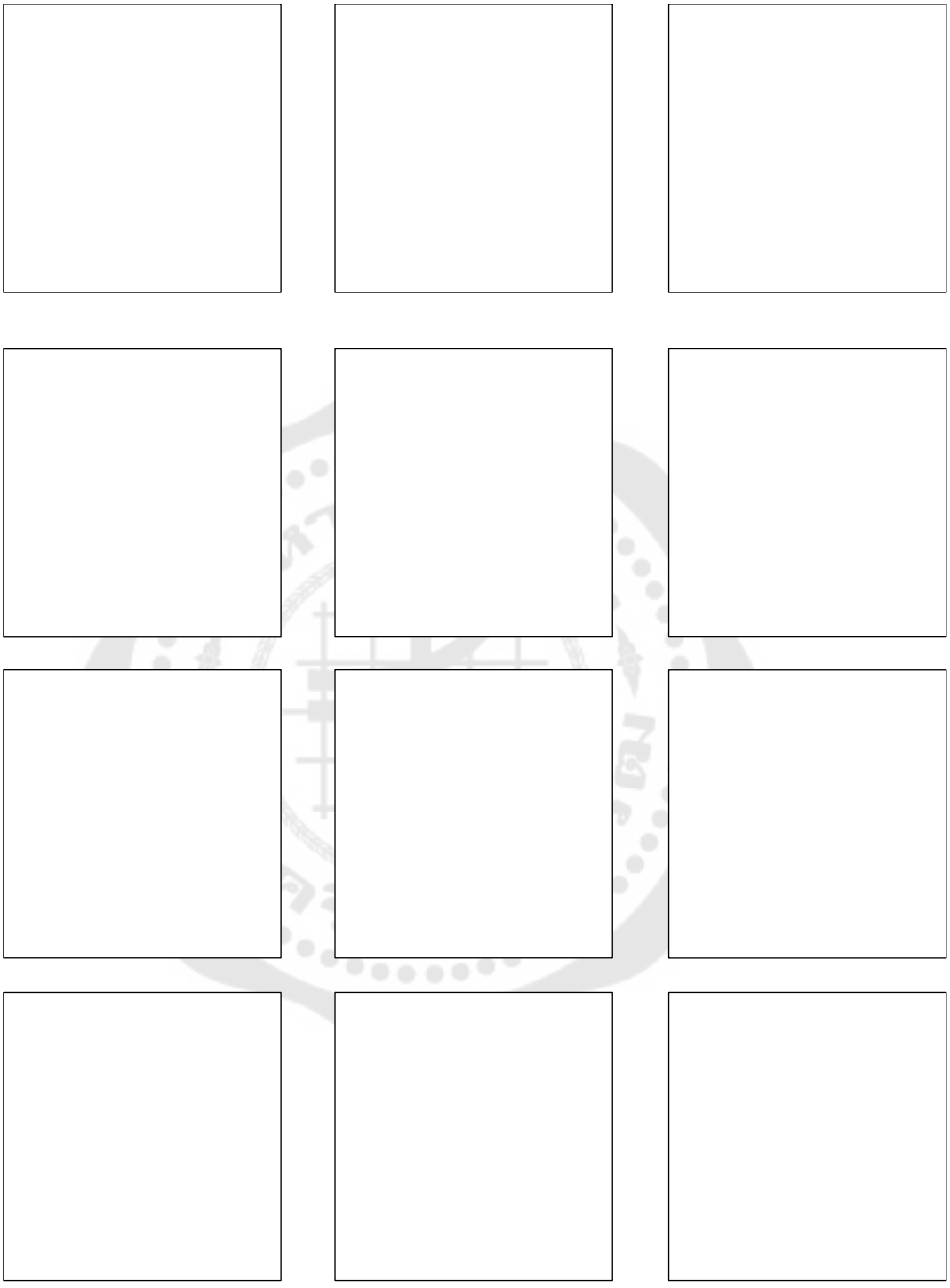
<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>Cat known as the Master Chef</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Combine professional development of their rich imagination.
(2) Be able to produce different kinds of food fluently.
(3) Can decorate the food carefully.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students can create creative works.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teacher publishes task document Inquiry-based Learning Program 7.1, read the instructions in the task document.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 7.1 and clarify the activity requirements.</td></tr>
<tr><td>Step2 Exploration (Homework)</td><td colspan="2">Students are encouraged to generate creative ideas by reading picture books, searching the Internet, or exploring their surroundings.</td><td>Students generate ideas after independent exploration and draw their ideas in the Inquiry-based Learning Program 7.1. For example, they might design cat-made treats, such as cat's claw creme fraiche, fish</td></tr>
</table>

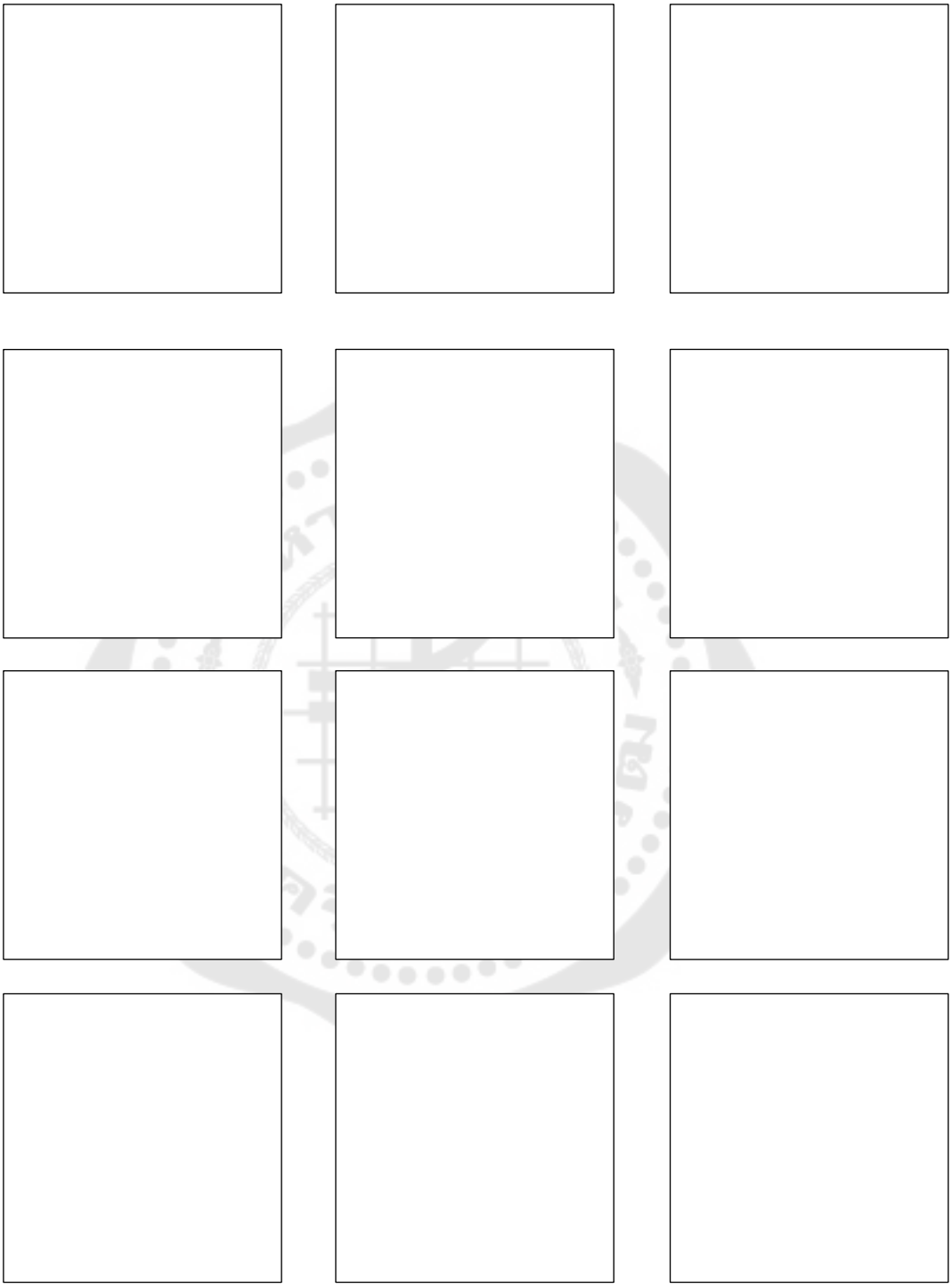
		cat's claw chocolate, chicken leg flavored cat's claw candy, etc.
Step3 Explanation (classroom)	Ask students to introduce their own design, including the name of the work, physical features and details such as the creativity behind the work and the creative elements added to the design.	In the design draft of their Inquiry-based learning program 7.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

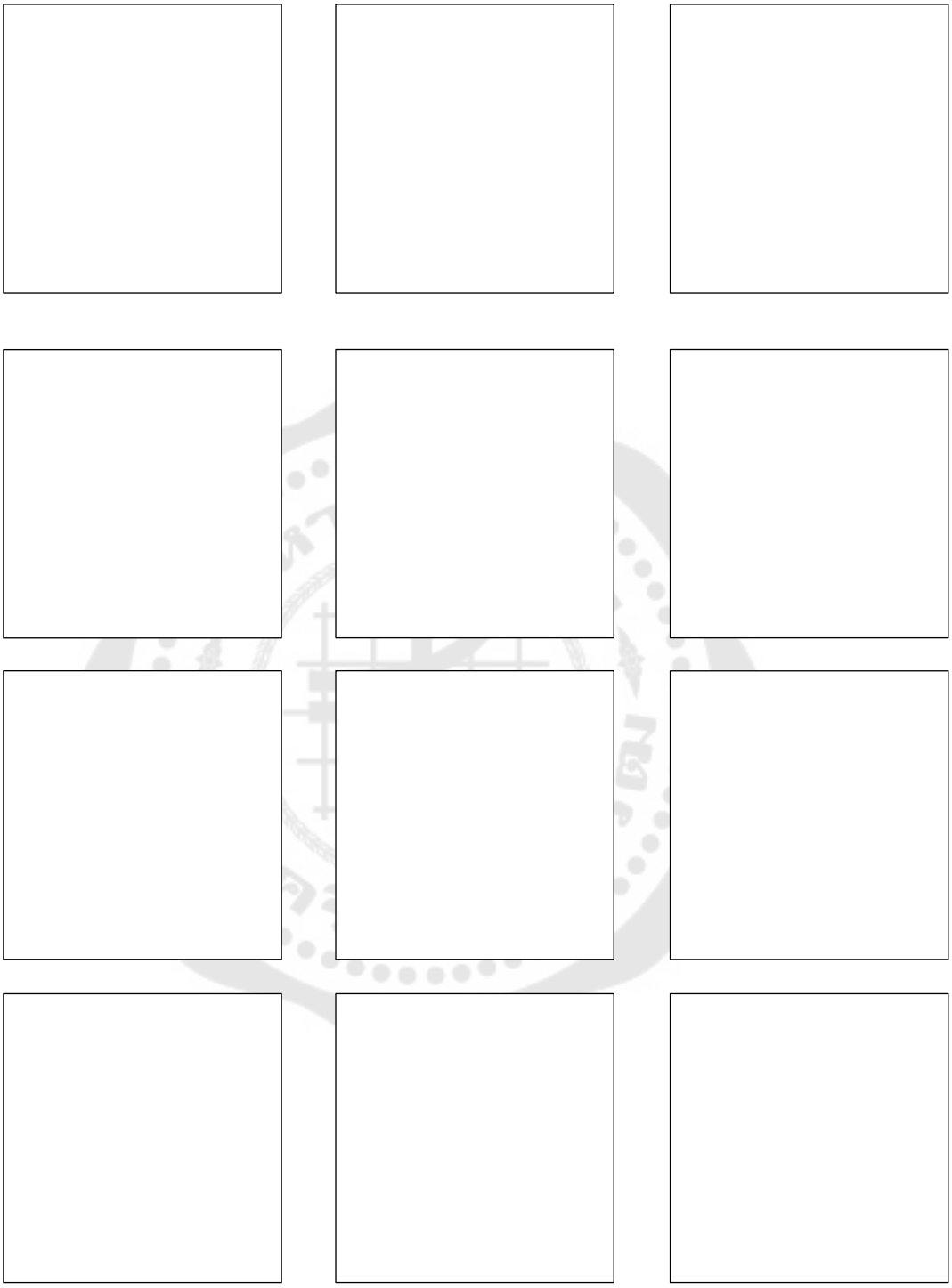
Inquiry-based learning program 7.1

Name: Creation theme: Cat known as the Master Chef

In a small town on the edge, a cat in a white apron is known for his cooking skills. When the town is hit by a storm, the cat steps in and leads the residents to overcome the famine and create a delicious meal. Imagine what kind of food the cat would create based on this passage. There are 36 blank squares below. In these squares, draw the visual features of the cat's dish, making sure to depict the differences in intricate detail. This activity requires teams of 2-3 people to work together. Finally, please select the most creative design from the 36 activity design drawings for the creation of this activity, and create a 3D three-dimensional work according to your design. If you have more than 36 ideas, you can use additional new paper to continue drawing your ideas, the number is unlimited. This document serves as a draft design for the activity. Please print it before you start drawing. At the end of the course, display your drawn design on the classroom display wall.







Inquiry-based learning program 8

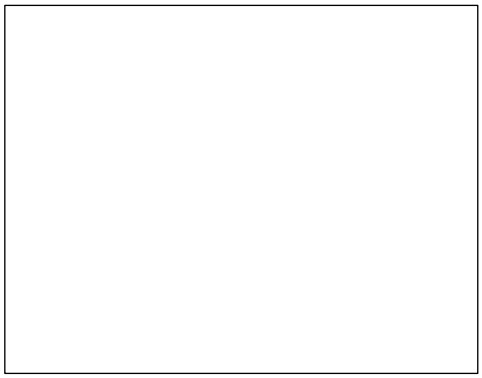
Course title	Technics of dough modeling		
Course content	The Gift for Totoro	Teaching time	3h
Textbook	Technics of dough modeling (second edition)		
1. Objective			
(1) Can express their ideas more richly with dough modeling works. (2) Can boldly use various materials to carry out creative design. (3) Experience the fun of cooperating with peers to stimulate students' creative development.			
2. Teaching key and difficult points Key point: Totoro production method Difficult point: Totoro three-dimensional production			
3. Materials Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.) Mud mask			
4. Teaching Process			
Teaching process	Teacher behavior	Student behavior	
Step1 Engagement (Homework)	Teachers publish task document Inquiry-based Learning Program 8.1, read the instructions in the task document and explain them.	Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 8.1 and clarify the activity requirements.	
Step2 Exploration (Homework)	Students are encouraged to generate creative ideas by reading picture books, searching the Internet, or exploring their surroundings.	Students generate ideas after independent exploration and draw their ideas in the Inquiry Learning Program 8.1. For example, they might design a gift for the Totoro, such as a Totoro bouquet decorated with colorful flowers, or a box of beautifully	

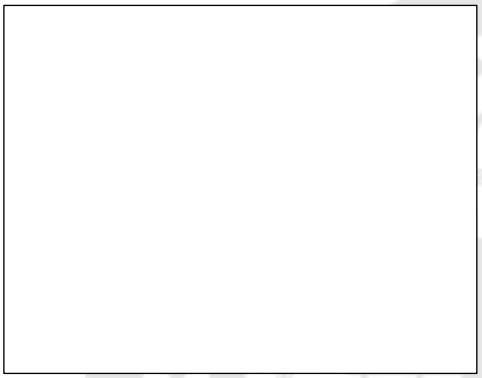
		made Totoro chocolates.
Step3 Explanation (Classroom)	Let the students introduce their own design scheme, what gift to give Totoro, including the gift scene, the characteristics of the gift, the creative elements added in the design and other details.	In the design draft of their Inquiry-based learning program 8.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

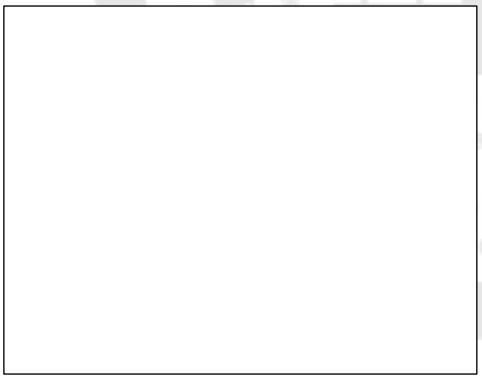
Inquiry-based learning program 8.1

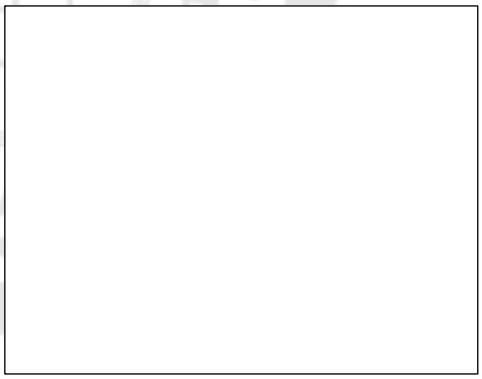
Name: Creation theme: The Gift for Totoro

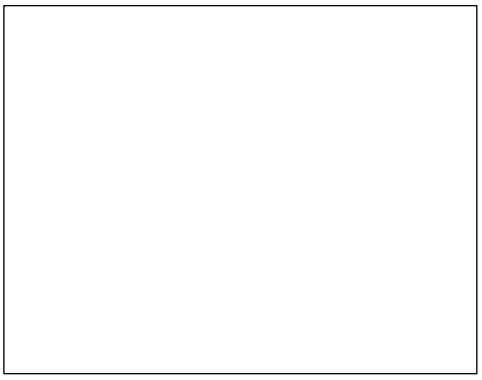
This activity requires a group of four individuals to collaborate. Utilize your imagination to draw a gift for Totoro from the 16 blank grids provided below. The gift can be an object or anything else you envision. Use as many elements as possible to create a rich scene and provide a detailed description of your idea. For example, you might choose to gift Totoro a bicycle by a forest lake, detailing the bicycle's shape, wheels or chain, and the environment by the lakeside, such as flowers, grass, and trees. This design will serve as your activity guide. Finally, choose the best design from the 16 active design drawings to create the 3D scene. If you have more than 16 ideas, you can use additional paper to continue drawing your ideas, the number is unlimited. Please print before drawing and display the completed design on the classroom wall at the end of each class.

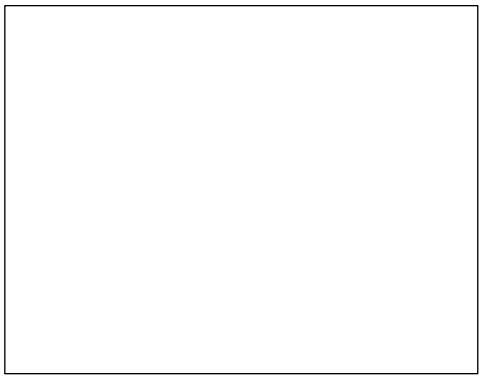












Inquiry-based learning program 9

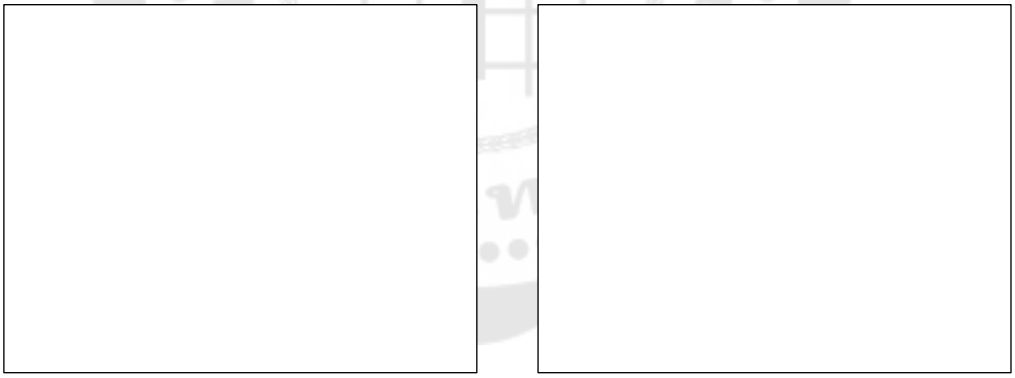
<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>Doraemon's Most Desired Destination</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Understand the rich expression of dough modeling skills.
(2) They can paint and finally express their ideas by making dough-modeling works.
(3) Feel the novelty brought by the course and get the happiness of creation in the course.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Key: Doraemon production method Difficulty: Doraemon three-dimensional production</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teachers publish task document Inquiry-based Learning Program 9.1, read the instructions in the task document and explain them.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 9.1 and clarify the activity requirements.</td></tr>
<tr><td>Step2 Exploration (Homework)</td><td colspan="2">Students are encouraged to generate creative ideas by reading picture books, searching the Internet, or exploring their surroundings. Students' imaginations can also be stimulated by examples. For example, tell them that they can imagine</td><td>Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 9.1.</td></tr>
</table>

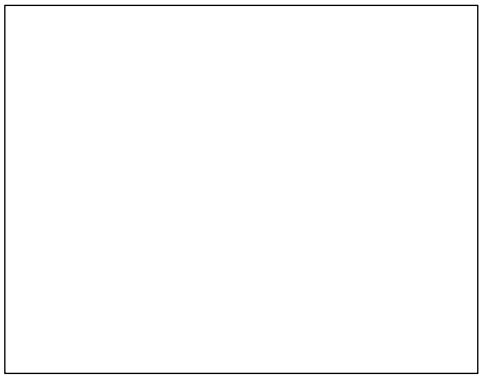
	that Doraemon might want to explore the remains of ancient civilizations and solve mysterious puzzles.	
Step3 Explanation (Classroom)	Have students introduce their design proposal and explain details such as where they think Doraemon went and the creative elements that were added to the design.	In the design draft of their Inquiry-based learning program 9.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

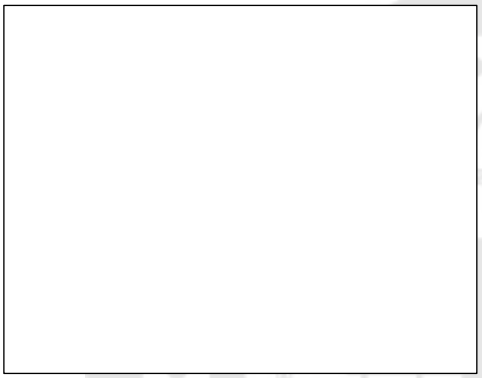
Inquiry-based learning program 9.1

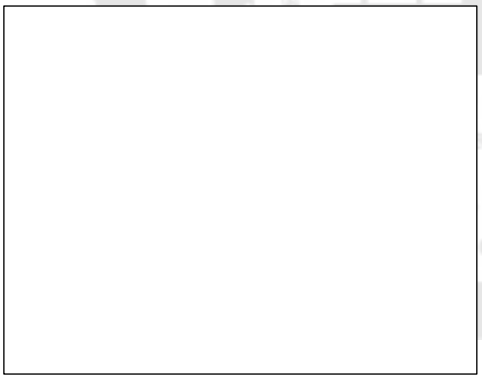
Name: Creation theme: Doraemon's Most Desired Destination

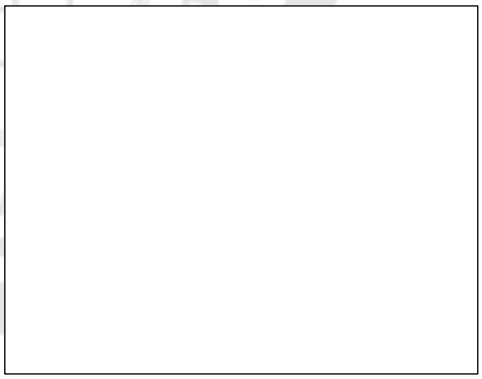
This activity is for a group of 5 people; you have to do it with your partner. Please use your imagination and draw in the 10 blank forms below where you think Doraemon would most like to go or where you would like to take Doraemon. Ask to use as many elements as possible to enrich the picture and describe your ideas in detail. Finally, choose the best design from the 10 active design drawings to create the 3D scene. If you have more than 10 ideas, you can use additional paper to continue drawing your ideas, the number is unlimited. Here are the plans for your event. Please print it out before drawing and post the finished design on the classroom wall at the end of each class.

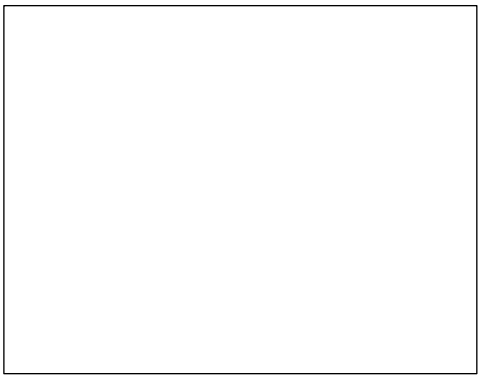


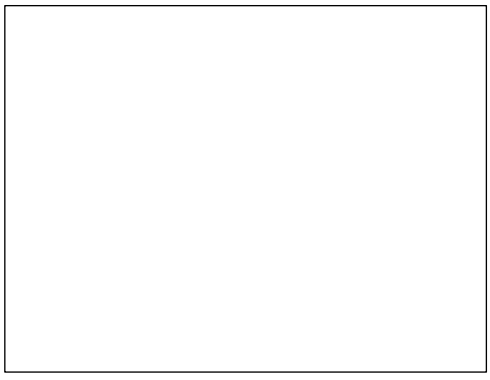












Inquiry-based learning program 10

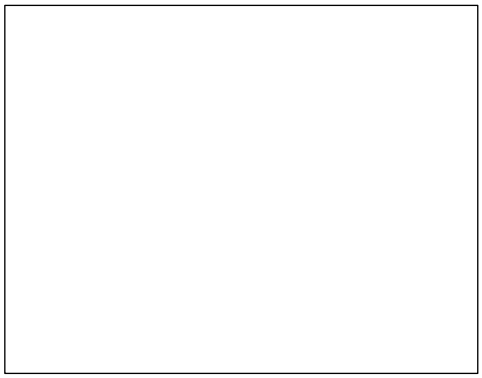
<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>Mr. Pig's Sunshine Party</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) The collision of ideas brought about by the perception of dough modeling.
(2) Able to expand the theme is content with dough modeling works to enrich the presentation.
(3) Get the happiness of the collision of ideas in the peer cooperation, enhance the feelings between classmates, and improve the fun of the class.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Key point: the production method of pig difficult point: the three-dimensional production of pig</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teachers publish task document Inquiry-based Learning Program 10.1, read the instructions in the task document and explain them.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 10.1 and clarify the activity requirements.</td></tr>
<tr><td>Step2 Exploration (Homework)</td><td colspan="2">Students are encouraged to generate creative ideas by reading picture books, searching the Internet, or exploring their surroundings.</td><td>Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 10.1.</td></tr>
</table>

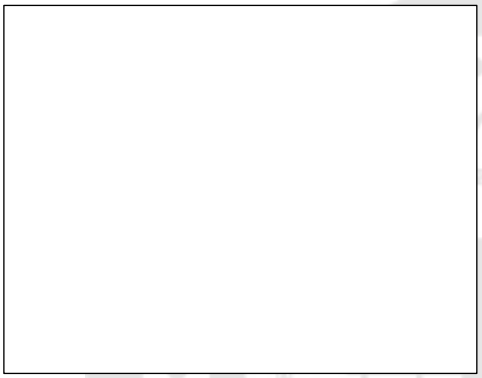
Step3 Explanation (Classroom)	Ask students to introduce their own design plan, such as what activities are arranged for Mr. Piggy's party, what food is prepared, who the participants are, the decoration of the venue and the creative elements added in the design.	In the design draft of their Inquiry-based learning program 10.1, students will select the design they think is the most creative, present the design drawings in class, and introduce their own work, explaining the creative concept of their work.
Step4 Elaboration (Classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling. In this hands-on phase, the students' independent efforts enable them to refine their mastery of dough modeling techniques and enhance their comprehension of the art of dough- modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

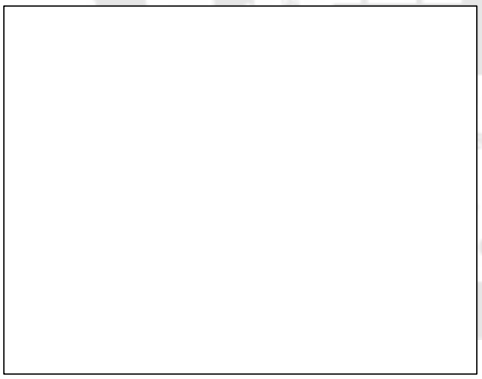
Inquiry-based learning program 10.1

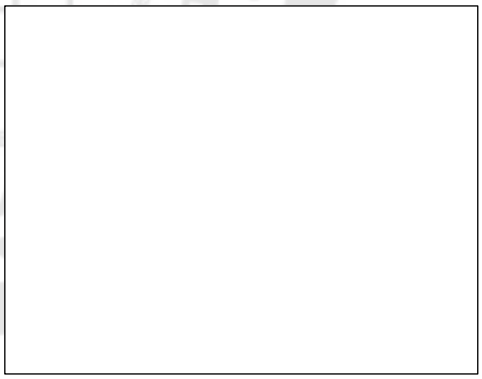
Name: Creation theme: Mr. Pig's Sunshine Party

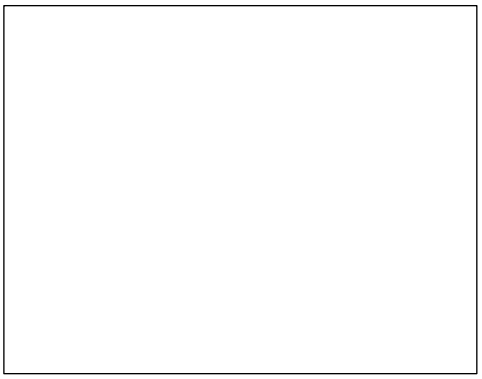
The theme is a team of five, and you must work with your partner. You and your partner are planning a party for Mr. Piggy. Use your imagination and draw Mr. Piggy's party scene in the 8 blank Spaces below. Use as many elements as possible to enrich the scene and describe your ideas in detail to create a satisfying and happy picture. Finally, choose the best design from the 8 active design drawings and use dough modeling to create the 3D scene. If you have more than 8 ideas, you can use additional paper to continue drawing your ideas, the number is unlimited. This is the design for your event. Please print it out before you finish drawing it and post the finished design on the classroom wall at the end of each class.

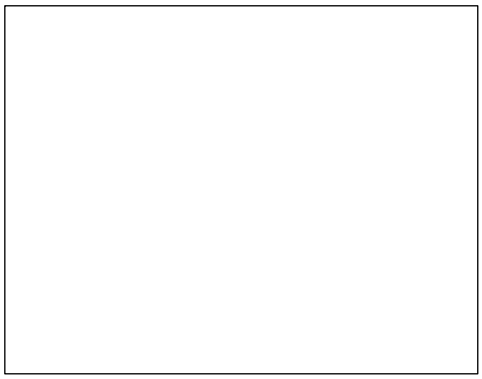












Inquiry-based learning program 11

<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>My Dream Cottage</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) The collision of ideas brought by the perception of dough modeling.
(2) Expand the content of the theme and present it with dough modeling works.
(3) The happiness of the collision of ideas in the cooperation of peers can enhance the feelings between classmates and the fun of the class.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students can create creative works.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teachers publish task document Inquiry-based Learning Program 11.1, read the instructions in the task document and explain them.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 11.1 and clarify the activity requirements.</td></tr>
<tr><td>Step2 Exploration (Homework)</td><td colspan="2">Students are encouraged to generate creative ideas by reading picture books, searching the Internet, or exploring from their surroundings.</td><td>Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 11.1</td></tr>
</table>

Step3 Explanation (classroom)	Have students present their design proposal, including the architectural features of the house they designed, the interior layout, the color scheme, the furniture placement, and the creative elements incorporated into the design.	Students must present their creative manuscripts in class and briefly explain the creative significance of the work they are about to complete.
Step4 Elaboration (classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students, guided by their chosen designs, embark on the creation of tangible artworks using dough modeling.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

Inquiry-based learning program 11.1

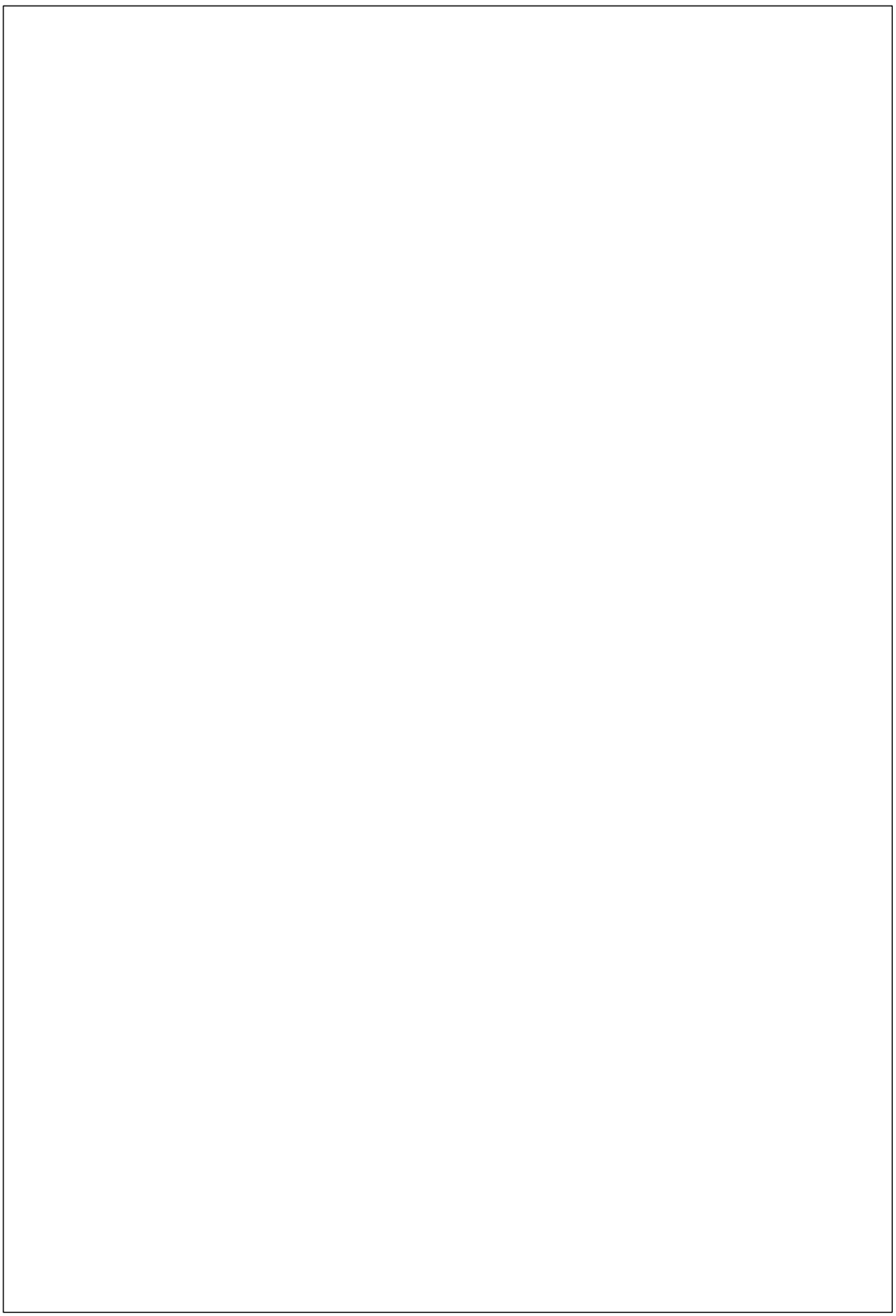
Name: Creation theme: My Dream Cottage

Today is my birthday, but I am very lonely, because I am a mouse, and I have lived in a wet sewer for a long, long time. In this dark and cold environment, I only dare to go out quietly at night to find food. You know what? It's too dangerous for me to go out in the daytime. I might frighten people and put myself in danger!

Every day, I silently hide in the sewer, secretly peep out the sunny world. The animals there, oh dear, they all have their own owners and cozy little houses! I really envy ah! They have warm places where they don't have to worry about the biting cold wind, let alone the dirty, smelly smell of the sewers.

Oh, what's covering my eyes. Wow, it's sweet. It's cake. I'm so lucky. Someone's cake fell down the drain and landed on my head. I want to wish quickly, wish I can have my own house soon! Give me a home, a little haven, a nice, warm, clean place, with a soft bed and warm light, where I can sleep at night.

The theme of this event is a group of 10 people. Please create a house suitable for the mouse friend to live in. What do you think the house of the mouse should be? Please play with your imagination, and I look forward to seeing your creativity and ideas. Please remember to add more details to the design drawings to make this dream house richer, warm, and engaging. For example, there might be a small bedroom with a soft, warm cushion as a cozy bed for a mouse friend. Hanging on the wall are some small decorations that mice like, such as small leaves and colorful toys, which add warmth and vitality to the cabin. Or something more interesting. Finally, please and your partner create a 3D scene of a dream cottage for the mouse using dough modeling according to the design drawings. Please print out the blank before drawing the design paper and post the design paper on the classroom wall after the course.



Inquiry-based learning program 12

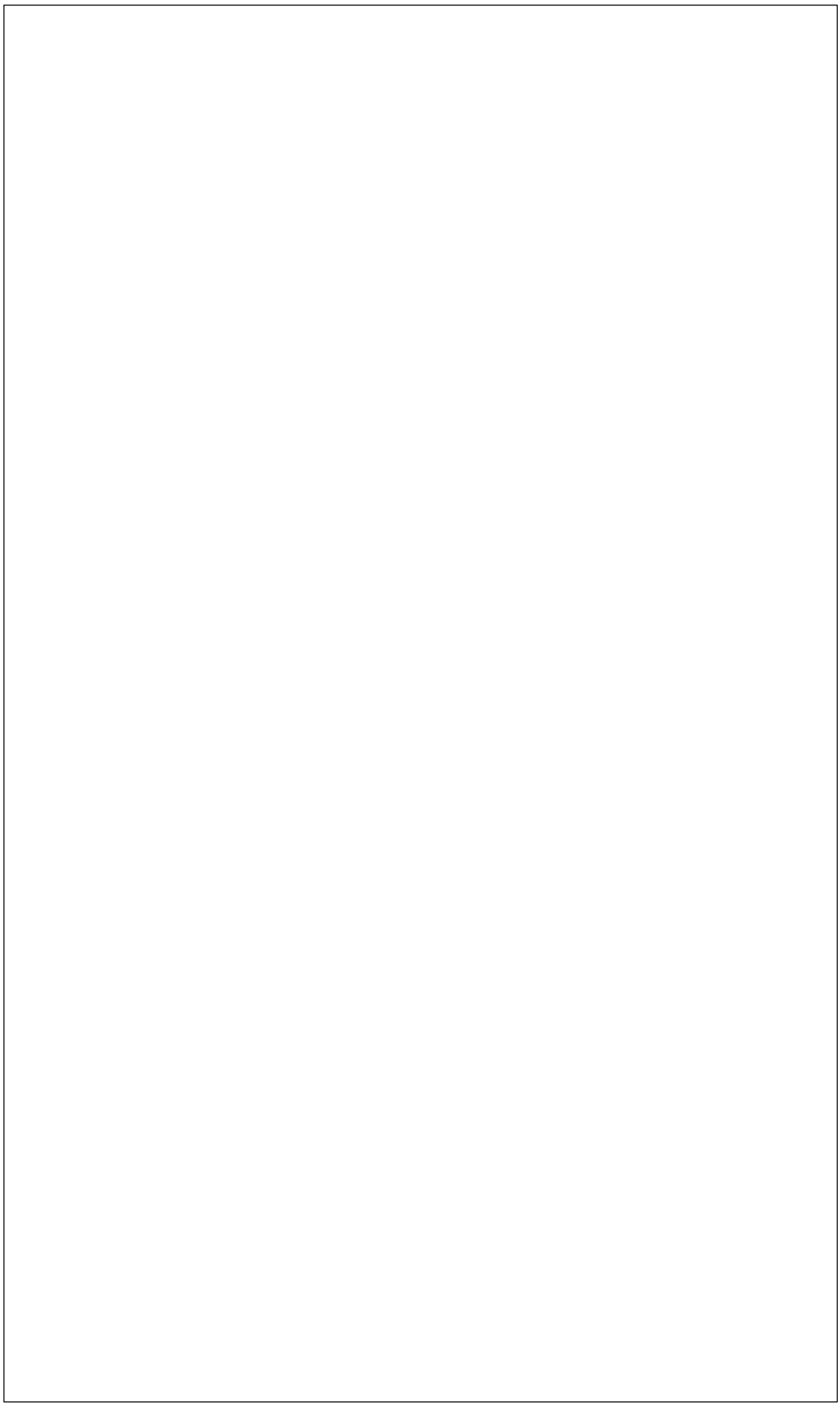
<table>
<tr><td>Course title</td><td colspan="3">Technics of dough modeling</td></tr>
<tr><td>Course content</td><td>The Happiest Dinner Moments</td><td>Teaching time</td><td>3h</td></tr>
<tr><td>Textbook</td><td colspan="3">Technics of dough modeling (second edition)</td></tr>
<tr><td colspan="4">1. Objective</td></tr>
<tr><td colspan="4">(1) Combine professional development of their rich imagination.
(2) Be able to produce different kinds of food fluently.
(3) It can decorate the food carefully.</td></tr>
<tr><td colspan="4">2. Teaching key and difficult points
Whether students can create creative works.</td></tr>
<tr><td colspan="4">3. Materials
Dough molding tools (plastic knife, platen, rolling pin, Vaseline, scissors, etc.)
Mud mask</td></tr>
<tr><td colspan="4">4. Teaching Process</td></tr>
<tr><td>Teaching process</td><td colspan="2">Teacher behavior</td><td>Student behavior</td></tr>
<tr><td>Step1 Engagement (Homework)</td><td colspan="2">Teachers publish task document Inquiry-based Learning Program 12.1, read the instructions in the task document and explain them.</td><td>Listen carefully to the teacher's reading instructions in Inquiry-based Learning Program 12.1 and clarify the activity requirements.</td></tr>
<tr><td>Step2 Exploration (Homework)</td><td colspan="2">Students are encouraged to generate creative ideas by searching the Internet or exploring from their surroundings.</td><td>Students generate ideas through independent exploration and draw their ideas in Inquiry-based Learning Program 12.1.</td></tr>
</table>

Step3 Explanation (classroom)	Let students introduce their own design scheme, such as the introduction of food types, composition and collocation, and the introduction of creative elements in the design.	Students must present their creative manuscripts in class and briefly explain the creative significance of the work they are about to complete.
Step4 Elaboration (classroom)	Organize students to enter the practical phase, instructing them to create a finished dough- modeling based on their design sketches. Supervise the students during this practical stage to ensure they receive effective hands-on practice, and encourage them to boldly express their creativity.	Students create dough-modeling works.
Step5 Evaluation (Classroom)	The teacher let the students show their finished products, selected the most creative works together with the students, and summarized the class.	Students present their finished products and choose the most creative ones. Summarize the difficulties and gains in the activity.

Inquiry-based learning program 12.1

Name: Creation theme: The Happiest Dinner Moments

The theme of this event is a group of 10 people, you and your partner need to create a table of food feast using dough modeling. For example, I plan to make four cold dishes, six hot dishes, one dessert, one fruit, and one soup. Of course, you can choose dishes according to your preferences, but make sure the dishes are varied enough to satisfy ten people. Use your imagination and expertise to create the perfect feast. Through the creative shaping of the dough, the forms and characteristics of various cuisines are reproduced, such as the steaming of hot dishes, colorful cold dishes, the tender texture of sweet fruits, and the attractive appearance of desserts. Imagine that you will be laughing with family or friends, eating good food, and creating a pleasant and warm atmosphere together. This is a draft of your event. Please print them out before finishing the drawing and post them on the classroom wall at the end of each class to share the food world you have created.



APPENDIX 3 Experimental group students part of the work

The first activity: The strangest pumpkin

The second activity: A magical enchanted tree

The third activity: Never-fading rose

Withered rose

The fourth activity: Monster Appearance

The fifth activity: A flying rabbit

The sixth activity: World Noodle Beauty Pageant

VITA