

Supplementary Materials

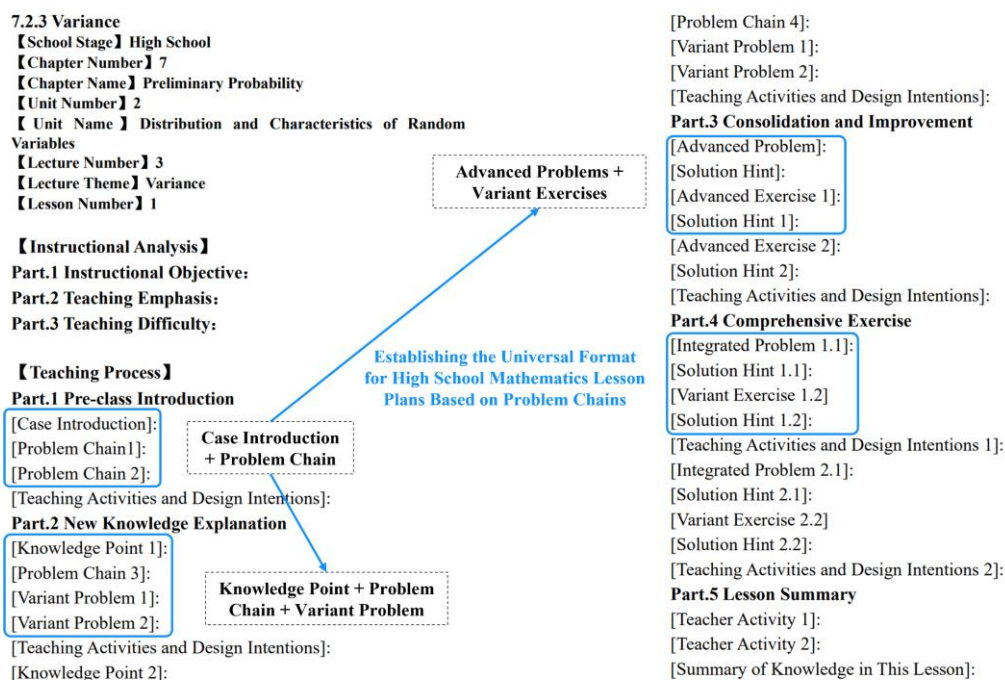


Fig.1 Instructional Design Structure

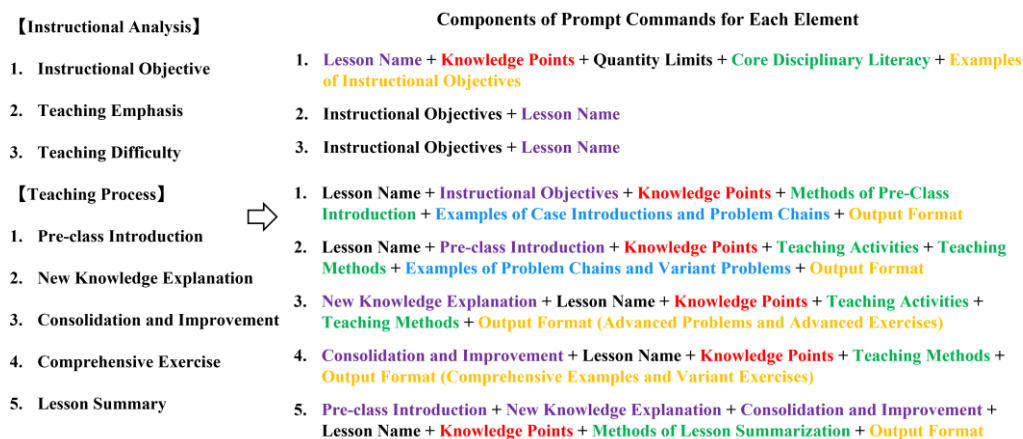


Fig.2 Design of prompt commands corresponding to each element in the instructional design structure

Table.1 Example Content of Knowledge Points for Each Unit in Chapter 13 "Statistics" of High School Mathematics Textbook

Chapters	Units	Course Themes	Knowledge Point Content
Chapter 13 "Statistics"	Population and Sample	Population and Sample	Population, Individual, Population Size, Sample, Sample Size or Sample Capacity, Sample Statistics, Population Numerical Characteristics in Statistical Problems
	Data Acquisition	Data Acquisition	Observational Data, Experimental Data, Census, Sampling, Sample Survey
	Sampling Methods	Simple Random Sampling	Simple Random Sampling, Lottery and Number Tag Methods, Random Number Table Method, Random Number Method
		Stratified Random Sampling	Stratified Random Sampling or Stratified Sampling, Methods of Stratified Sampling
	Statistical Charts	Frequency Distribution Table and Frequency Histogram	Steps to Plot a Frequency Distribution Table, Range, Class Interval and Number of Classes, Frequency Histogram, Title, Annotations, Frequency Polygon or Frequency Line Graph
		Stem-and-Leaf Plots and Scatter Plots	Stem-and-Leaf Plots, Scatter Plots
	Statistical Estimation	Estimating Population Distribution	Population Distribution Density Curve
		Estimating Population Numerical Characteristics	Numerical Characteristics of a Data Set, Central Tendency and Dispersion of a Data Set, Summation Symbol, Standard Deviation of Sample Data
		Estimating Percentiles	Percentiles, kth Percentile
	Statistical Activities	Statistical Activities	Main Processes of Statistical Activities, Concept of Statistical Estimation

Unit Name

Lesson Name

JM

假如你是一位高中数学教师，请设计“统计”单元的“分层随机抽样”课的教学目标。请将“教学目标”概括为3条。需要包括的知识内容有：分层随机抽样或分层抽样、分层抽样的方法等。请不要超出知识内容进行设计。 **This lesson covers the following knowledge content**

下面是“教学目标”的示例：

- 1.利用同角的正弦、余弦、正切及余切的关系进行求值，深化对公式的理解，提升数学运算素养。
- 2.通过对三角恒等式的化简、证明，感受同角的正弦、余弦、正切、余切之间关系的内在联系，体会化归的数学思想，发展逻辑推理素养。
- 3.经历两角差的余弦公式的推导过程，知道两角差的余弦公式的意义，体会数形结合的思想。
- 4.能由两角差的余弦公式推导两角和的余弦公式，了解公式的内在联系。
- 5.灵活运用两角差与和的余弦公式进行简单的恒等变换，能解决求值、化简等有关问题，发展数学运算素养。

可选择的学科核心素养有：数学抽象、逻辑推理、数学建模、直观想象、数学运算、数据分析。

Mathematics Subject Core Literacy Prompt Command

针对“分层随机抽样”的单元课程，下面是我设计的3条“教学目标”：

Generated Bloom's Taxonomy for Instructional Objectives

1. 学生应理解并能清楚解释什么是“分层随机抽样”，并能详细说明其在数据收集和研究中的应用。强调在一些特定情况下，如何利用分层抽样更有效地获取样本，增强数据分析能力和数学抽象思维。 **Knowledge Content of This Lesson**
2. 学生需要掌握分层抽样的具体步骤和方法，能自主设计出分层抽样的实施方案。了解和识别在实际生活中或理论研究中可能遇到的分层抽样的相关问题，提升逻辑推理和数学建模素养。 **Core Literacy Corresponding to This Instructional Objective**
3. 学生应能运用分层抽样的知识，分析和解决一些实际问题。例如，在一项调查研究中，如何通过分层抽样设计出一个有效的样本。不仅要能够运用，还需要能够理解和解释结果，发展直观想象和数学运算能力。

Fig.3 Instructional Objectives Prompt Command and Generated Result Example

Table.2 Instructional Objectives Prompt Command and Generated Result Example

Teaching Steps	Prompt Design & Question-Answer Examples
Instructional Objective	Prompt: Lesson Name + Knowledge Points + Quantity Limits + Core Disciplinary Literacy + Examples of Instructional Objectives
	<p>Question:</p> <p>Assuming you're a high school mathematics teacher, design the "instructional objectives" for the lesson on "Stratified Random Sampling" in the "Statistics" unit. Please summarize the "instructional objectives" in 3 points. The knowledge content should include: stratified random sampling or stratified sampling, methods of stratified sampling, etc. Please refrain from going beyond the given knowledge content.</p> <p>Here are examples of "instructional objectives":</p> <p>(1) Utilize relationships between the sine, cosine, tangent, and cotangent of the same angle for evaluations, deepen the understanding of formulas, and enhance mathematical computational proficiency.</p> <p>(2) Through simplification and proof of trigonometric identities, appreciate the intrinsic connection between the sine, cosine, tangent, and cotangent of the same angle. Grasp the mathematical concept of reduction, and develop logical reasoning skills.</p> <p>(3) Experience the derivation process of the cosine formula for the difference between two angles, understand the significance of the cosine formula for the angle difference, and appreciate the combined idea of mathematics and geometry.</p> <p>(4) From the cosine formula for the difference between two angles, derive the cosine formula for the sum of two angles, and comprehend the inherent connection between the formulas.</p> <p>(5) Flexibly apply the cosine formulas for angle differences and sums to conduct simple identity transformations. Solve related evaluation and simplification problems, enhancing mathematical computational proficiency.</p> <p>Available core competencies to choose from: Mathematical abstraction, logical reasoning, mathematical modeling, intuitive imagination, mathematical operations, data analysis.</p>
	<p>Answer:</p> <p>(1) Students should understand and be able to clearly explain what "Stratified Random Sampling" is, and elaborate on its applications in data collection and research. Emphasize how to utilize stratified sampling more effectively to obtain samples in specific scenarios, enhancing data analysis skills and mathematical abstract thinking.</p> <p>(2) Students should master the specific steps and methods of stratified sampling, and be able to design an implementation plan for stratified sampling independently. Recognize and identify potential problems related to stratified sampling that may be encountered in real life or theoretical research, improving logical reasoning and mathematical modeling proficiency.</p> <p>(3) Students should be able to apply the knowledge of stratified sampling to analyze and solve some practical problems. For instance, in a survey study, how to design an effective sample using stratified sampling. They should not only be capable of application but also understand and explain the results, fostering intuitive imagination and mathematical computational skills.</p>

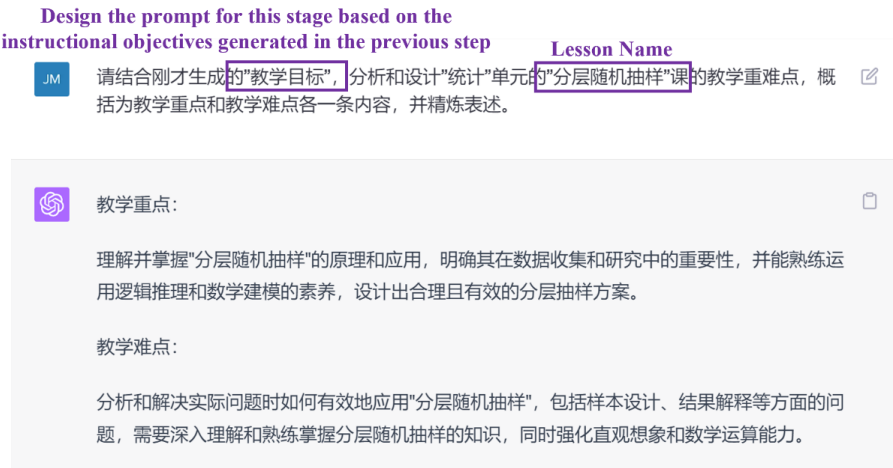


Fig.4 Teaching Difficulties and Emphasis Prompt Command and Generated Result Example

Table.3 Teaching Difficulties and Emphasis Prompt Command and Generated Result Example

Teaching Steps	Prompt Design & Question-Answer Examples
Teaching Emphasis and Difficulty	Prompt: Instructional Objectives + Lesson Name
	Question: Based on the previously generated "Instructional Objective", analyze and design the Teaching Emphasis and Difficulty for the "Stratified Random Sampling" lesson in the "Statistics" unit. Summarize into one key point for Teaching Emphasis and one for Teaching Difficulty, and express it concisely.
	Answer: (1) Teaching Emphasis: Understand and master the principles and applications of "Stratified Random Sampling", clarify its importance in data collection and research, and proficiently use logical reasoning and mathematical modeling skills to design a reasonable and effective stratified sampling scheme. (2) Teaching Difficulty: Effectively applying "Stratified Random Sampling" when analyzing and solving real-world problems, including issues related to sample design and result interpretation. This requires a deep understanding and mastery of stratified random sampling knowledge, while also strengthening intuitive imagination and mathematical computation skills.

Prompt Based on the Instructional Objective Generated in the Previous Step

现在你正在设计教案中的“课前导入”，随后还有“新知讲解”、“巩固提高”、“课堂练习”、“课堂小结”的环节需要你设计。

Knowledge Content of This Lesson

请结合刚刚生成的“教学目标”，分析和设计“统计”单元的“分层随机抽样”课的“课前导入”教学活动，请注意与之后将要设计的环节的前后衔接。本节课将会讲授的**知识内容有：分层随机抽样或分层抽样、分层抽样的方法等**。“课前导入”可以从参考以下方法：提问导入、问题导入、数学历史导入、数学故事导入、情境导入、媒体导入、图表导入、实物导入、预习导入、对比导入、音乐或艺术导入等。

Referable Methods for Lesson Introduction

请以详细的、具体的教案形式，分为引例和基于引例的问题链告诉我，并在最后提供可能的教学活动和设计意图。请注意，引例和问题链需要包含具体的、详细的数值和问题。请不要超出知识内容进行设计。如果需要计算，请列出数学公式，并将数值代入公式使用插件计算。

Lesson Introduction Phase:

下面是“课前导入”的示例：

Few-shot Example of Problem Chain Prompt

[引例]：在直角三角形中对锐角的正弦、余弦、正切及余切进行了定义，这四个值与直角三角形中的哪些量有关？

[问题链1]：借助平面直角坐标系如何定义任意角的正弦、余弦、正切、余切呢？

[问题链2]：角 α 的正弦、余弦、正切、余切是否对任意角都有意义？

[教学活动和设计意图]：通过创建相关的场景，引起学生的兴趣，并在具体的情境中引出新的概念，从而让学生更好地理解和接受定义和公式。

课前导入：

Automatically Selected Situational and Problem-based Introduction Method

[引例]：假设我们作为一个市场研究公司，被一个大型超市委托进行一项关于消费者购买习惯的研究。我们的任务是抽样调查超市的顾客，但是超市的顾客众多且各不相同。我们可以简单地随机抽取一些人，但是这可能会导致一些群体（如年轻人或老年人）的代表性不足。如何设计一个更有效的抽样方案？

Problem Chain Generation

[问题链1]：对于这样一个复杂的人群，如果我们仅仅使用简单随机抽样，会有什么问题？是否可能存在某些群体的样本不足？

[问题链2]：如何避免简单随机抽样中的这个问题？我们能否将人群按照某种特征进行分类，然后从每个类别中抽取一定比例的样本？

[问题链3]：这种分组抽样的方式是否有一个特殊的名字？它的主要步骤和方法是什么？

Generation of Referable Teaching Activities and Design Intentions

[教学活动和设计意图]：通过设定一个真实的场景，引发学生对分层随机抽样的兴趣。让学生思考如何解决实际问题，从而自然地引出分层随机抽样的概念。这种方法能让学生更好地理解分层随机抽样的原理和应用，并在之后的学习中能更好地运用分层随机抽样解决实际问题。

Fig.5 Pre-class Introduction Phase Prompt Command and Generated Result Example

Table.4 Pre-class Introduction Phase Prompt Command and Generated Result Example

Teaching Steps	Prompt Design & Question-Answer Examples
Pre-class Introduction	Prompt: Lesson Name + Instructional Objectives + Knowledge Points + Methods of Pre-Class Introduction + Examples of Case Introductions and Problem Chains + Output Format
	<p>Question:</p> <p>You are currently designing the "Pre-class Introduction" in the teaching plan. Subsequently, there will be segments on "New Knowledge Explanation," "Consolidation and Improvement," "Comprehensive Exercise," and "Lesson Summary" that you need to design.</p> <p>Please integrate the previously generated "Instructional Objective" to analyze and design the "Pre-class Introduction" teaching activity for the "Stratified Random Sampling" lesson in the "Statistics" unit. Please ensure smooth transition and continuity with the segments that will be designed later. The knowledge content to be taught in this lesson includes: stratified random sampling or stratified sampling, and the methods of stratified sampling. The "Pre-class Introduction" can refer to the following methods: inquiry introduction, problem introduction, history of mathematics introduction, math story introduction, scenario introduction, media introduction, chart introduction, real object introduction, preview introduction, comparison introduction, and music or art introduction.</p> <p>Please provide a detailed and specific teaching plan, divided into a case introduction</p>

	<p>and a problem chain based on the case introduction. Note that the case introduction and the problem chain should contain specific and detailed values and problems.</p> <p>Please do not exceed the content knowledge in your design. If calculations are needed, list the mathematical formulas and plug in the values using a calculation plugin.</p> <p>Below is an example of the "Pre-class Introduction":</p> <p>[Case Introduction]: In a right triangle, the sine, cosine, tangent, and cotangent of an acute angle have been defined. Which quantities in the right triangle are these four values related to?</p> <p>[Problem Chain 1]: How can we define the sine, cosine, tangent, and cotangent of any angle using the Cartesian coordinate system?</p> <p>[Problem Chain 2]: Does the sine, cosine, tangent, and cotangent of angle α have meaning for any angle?</p> <p>[Teaching Activities and Design Intentions]: By creating relevant scenarios to arouse students' interest, new concepts are introduced in specific contexts, enabling students to better understand and accept definitions and formulas.</p>
	<p>Answer:</p> <p>[Case Introduction]: Suppose we are a market research company commissioned by a large supermarket to conduct a study on consumer purchasing habits. Our task is to sample the supermarket's customers, but the supermarket's customers are numerous and diverse. We could simply randomly select some people, but this may result in underrepresentation of certain groups, such as young people or the elderly. How can we design a more effective sampling scheme?</p> <p>[Problem Chain 1]: For such a complex population, what issues might arise if we only use simple random sampling? Is it possible that some groups may be under-sampled?</p> <p>[Problem Chain 2]: How can we avoid this issue in simple random sampling? Can we classify the population based on certain characteristics and then draw a proportional sample from each category?</p> <p>[Problem Chain 3]: Does this grouped sampling method have a specific name? What are its main steps and methods?</p> <p>[Teaching Activities and Design Intentions]: By setting up a real-world scenario, students' interest in stratified random sampling is sparked. It allows students to ponder how to address practical challenges, naturally leading to the introduction of the concept of stratified random sampling. This approach enables students to better grasp the principles and applications of stratified random sampling, and they can effectively apply it to solve real-world problems in subsequent learning.</p>

Referable Teaching Activities

Referable Teaching Methods

Prompt Based on the Lesson Introduction
Generated in the Previous Step

现在请你结合刚才生成的课前的情境，分析和设计“统计”单元的“分层随机抽样”课的“新知讲解”的内容。

Knowledge Content of This Lesson

本节课将会讲授的内容有：分层随机抽样或分层抽样、分层抽样的方法等。“新知讲解”的设计可以参考以下学习活动：小组讨论、引导活动、互动问答、在线学习、头脑风暴、角色扮演、实验活动、游戏活动、演示和展示、野外考察、课堂辩论、创作活动、自我反思、速记活动、书写故事或日记、制作图表或者模型、朗读、知识竞赛、合作学习等。可以参考的教学方法有：启发式教学法、合作学习法、情境学习法、项目式学习法、分层教学法、混合式学习法、探究式教学法、游戏化学习法、故事化教学法等。

请以详细教案的形式，对每个知识点分别设计详细的、具体的活动。注意与“课前导入”的前后衔接和问题的设计，依据课前导入的情境内容生成变式问题，并以问题链和变式问题的形式告诉我，并在问题后面提供可能的教学活动和设计意图。

请不要超出知识内容进行设计。如果需要计算，请列出数学公式，并将数值代入公式使用插件计算。

New Knowledge Explanation Phase:
Few-shot and Zero-shot Problem Chain Prompt Examples

下面是内容格式：

知识点：

[问题链3]：已知角 α 的终边经过点 $P(1,2)$ ，求角 α 的正弦、余弦、正切及余切值。

[变式问题1]：若将问题链3中点 P 的坐标改成 $P(a,-2a)(a>0)$ ，则角 α 的正弦、余弦、正切及余切值会发生变化吗？为什么？

[变式问题2]：已知角 α 的终边经过点 $P(a,-2a)(a<0)$ ，求角 α 的正弦、余弦、正切及余切值。

[教学活动和设计意图]：

Few-shot Prompt

知识点：

[问题链4]：

[变式问题1]：

[变式问题2]：

[教学活动和设计意图]：

Zero-shot Prompt

知识点：

[问题链5]：

[变式问题1]：

[变式问题2]：

[教学活动和设计意图]：

Zero-shot Prompt

新知讲解：

Knowledge Points Designed and Generated Based on the Knowledge Content of This Lesson

知识点1：什么是分层随机抽样？

[问题链1]：通过课前导入，我们已经对超市的顾客群体进行了分类，那么这样的操作是否能解决我们之前讨论的简单随机抽样可能存在的问题？**Problem Chain and Variational Problems Corresponding to the Knowledge Points**

[变式问题1]：假设我们按照性别和年龄两个维度进行分类，每个类别中随机抽取一定数量的人进行调查，这种方法是否能更好地代表整体顾客群体？这种抽样方法叫什么？

[教学活动和设计意图]：**互动问答活动**，鼓励学生思考并回答问题，以引导他们自我发现分层随机抽样的概念。教学设计的目的是通过这个活动，让学生理解分层随机抽样是一种更有效的抽样方法，能更好地代表整个研究群体。

Generation of Referable Teaching Activities and Design Intentions for Teacher Reference

知识点2：如何进行分层随机抽样？

[问题链2]：我们已经知道了分层随机抽样的基本概念，那么接下来我们该如何进行分层随机抽样呢？如果我们超市的顾客按照性别和年龄两个维度进行分类，那么在每个类别中应该抽取多少人？

[变式问题1]：假设我们将男性顾客按照年龄分为：18-25岁、26-35岁、36-45岁、46岁以上，女性顾客也按照同样的年龄段进行分类，那么，在每个类别中我们应该抽取多少人呢？我们该如何决定？

[教学活动和设计意图]：**小组讨论活动**，帮助学生通过讨论和探索，来理解并掌握分层随机抽样的具体方法。通过这个活动，让学生理解分层随机抽样中需要考虑的因素和步骤，提升他们的逻辑推理和数学建模能力。

知识点3：分层随机抽样的优点和缺点

[问题链3]：现在我们已经知道了如何进行分层随机抽样，但是这种抽样方法是否一定比简单随机抽样更优呢？如果是，它的优点是什么？如果不是，它的缺点又是什么？

[变式问题1]：假设在我们的超市调查中，我们发现大部分的购物者都是中年女性，那么在这种情况下，分层随机抽样和简单随机抽样哪种方法更优呢？为什么？

[教学活动和设计意图]：**课堂辩论活动**，让学生对分层随机抽样的优缺点进行讨论和辩论，提升他们的逻辑推理和数据分析能力。通过这个活动，让学生深入理解分层随机抽样的优缺点，能更好地选择和运用合适的抽样方法解决实际问题。

Fig.6 New Knowledge Explanation Phase Prompt Command and Generated Result Example

Table.5 New Knowledge Explanation Phase Prompt Command and Generated Result Example

Teaching Steps	Prompt Design & Question-Answer Examples
New Knowledge Explanation	<p>Prompt: Lesson Name + Pre-class Introduction + Knowledge Points + Teaching Activities + Teaching Methods + Examples of Problem Chains and Variant Problems + Output Format</p>
	<p>Question:</p> <p>Now, please design the content for "New Knowledge Explanation" for the "Stratified Random Sampling" lesson in the "Statistics" unit, incorporating the context from the previously generated pre-class introduction.</p> <p>The new knowledge to be taught in this lesson includes: stratified random sampling or simply stratified sampling, and methods of stratified sampling. The design for "New Knowledge Explanation" can refer to the following learning activities: group discussions, guided activities, interactive Q&A, online learning, brainstorming, role-playing, experimental activities, game-based activities, demonstrations and presentations, field observations, classroom debates, creative activities, self-reflection, shorthand activities, writing stories or diaries, creating charts or models, reading aloud, knowledge contests, cooperative learning, etc. Teaching methods to refer to include: heuristic teaching, cooperative learning, situational learning, project-based learning, tiered instruction, blended learning, inquiry-based teaching, gamified learning, and storytelling teaching methods, etc.</p> <p>Please design detailed and specific activities for each knowledge point in the form of a detailed teaching plan. Ensure coherence with the pre-class introduction and the design of the problem chain. Generate variant questions based on the content of the pre-class introduction scenario, and present them in the form of problem chains and variant questions. After each question, provide possible teaching activities and design intentions.</p> <p>Please refrain from designing beyond the content scope. If calculations are needed, list the mathematical formulas and plug in the numbers using the relevant tools.</p> <p>Here is the content format:</p> <p>Knowledge Point 1: [Problem Chain 3]: Given that the terminal side of angle α passes through point P(1,2), find the sine, cosine, tangent, and cotangent values of angle α. [Variant Question 1]: If the coordinates of point P in Problem Chain 3 are changed to P(a,-2a) ($a>0$), will the sine, cosine, tangent, and cotangent values of angle α change? Why? [Variant Question 2]: Given that the terminal side of angle α passes through point P(a,-2a) ($a<0$), find the sine, cosine, tangent, and cotangent values of angle α. [Teaching Activities and Design Intentions]:</p> <p>Knowledge Point 2: [Problem Chain 4]: [Variant Question 1]: [Variant Question 2]: [Teaching Activities and Design Intentions]:</p> <p>Knowledge Point 3: [Problem Chain 5]: [Variant Question 1]: [Variant Question 2]: [Teaching Activities and Design Intentions]:</p>
	<p>Answer:</p> <p>Knowledge Point 1: What is stratified random sampling? [Problem Chain 4]: Based on the pre-class introduction, we have already categorized the supermarket's customer groups. Can such an operation solve the potential problems we discussed in simple random sampling? [Variant Question 1]: Suppose we categorize based on two dimensions: gender and age, and randomly select a certain number of people from each category for the survey. Can this method better represent the overall customer group? What is this sampling method called? [Teaching Activities and Design Intentions]: Interactive Q&A activity, encouraging students to think and answer questions, guiding them to discover the concept of</p>

	<p>"Introduction to New Knowledge" section.</p> <p>The new knowledge taught in this lesson includes: stratified random sampling or stratified sampling, methods of stratified sampling, etc. The design of the "Consolidation and Enhancement" section can refer to the following learning activities: group discussions, experimental activities, demonstrations and presentations, interactive Q&A, field investigations, classroom debates, creative activities, self-reflection, online learning, note-taking activities, brainstorming, writing stories or diaries, creating charts or models, knowledge competitions, collaborative learning, etc. The teaching methods you can refer to include: cooperative learning, complex problem-solving learning, project-based learning, tiered grouping learning, blended learning, inquiry-based teaching, and transfer analogy learning methods, etc.</p> <p>Please design the activities in detail, in the form of a detailed lesson plan. Ensure the coherence with the problem chain of the "Introduction to New Knowledge" section. Present it in the form of advanced questions and answer hints. At the end, include possible teaching activities and design intentions.</p> <p>Please do not go beyond the scope of the knowledge content in the design. If calculations are needed, please list the mathematical formulas and plug the numbers into the formulas for calculation.</p> <p>Here is the content format:</p> <p>[Advanced Question]:</p> <p>[Answer Hint]:</p> <p>[Advanced Exercise 1]:</p> <p>[Answer Hint 1]:</p> <p>[Advanced Exercise 2]:</p> <p>[Answer Hint 2]:</p> <p>[Teaching Activities and Design Intentions]:</p> <p>Answer:</p> <p>[Advanced Question]: Suppose a supermarket has four main customer groups: students, office workers, retirees, and freelancers. Their consumption habits and needs in the supermarket might differ. Now, if the supermarket wants to understand the consumption needs and habits of each customer group, how should stratified sampling be carried out? And how should the number of samples to be drawn from each group be determined?</p> <p>[Answer Hint]: First, stratify based on the supermarket's customer groups (students, office workers, retirees, and freelancers). Then, randomly draw a certain number of samples from each stratum. When determining the number of samples to be drawn from each stratum, consider the proportion of that stratum in the overall population, and factors like the importance of each group can also be considered.</p> <p>[Advanced Exercise 1]: To gain a deeper understanding of customer shopping habits, the supermarket decided to add a question to the sample survey: What type of products do you usually purchase in the supermarket? Please design a simple survey form and explain your design rationale.</p> <p>[Answer Hint 1]: When designing the survey form, it should include questions related to the customer's personal information (such as gender, age, occupation, etc.) as well as questions about shopping habits (like the most commonly purchased product types, shopping frequency, etc.). The design rationale is to understand the customer's shopping habits in as much detail as possible, providing the supermarket with a more effective basis for decision-making.</p> <p>[Advanced Exercise 2]: If you were the statistician for this supermarket, how would you use the results of stratified random sampling to formulate more effective sales strategies? Please explain your rationale in as much detail as possible.</p> <p>[Answer Hint 2]: The results of stratified random sampling can reveal the shopping needs and habits of various customer groups. This can assist the supermarket in formulating more accurate sales strategies targeting different groups. For instance, if survey results show that the student group prefers to buy snacks, while retirees prefer health foods, the supermarket could make corresponding adjustments in product arrangement, promotional activities, etc.</p> <p>[Teaching Activities and Design Intentions]: In this section, through designing advanced questions and exercises, students are encouraged to apply the knowledge</p>
--	---

	they've learned to real-world problems, enhancing their problem-solving and logical reasoning abilities. At the same time, these questions and exercises also offer students an opportunity to test and consolidate their knowledge.
--	--

	<p>Prompt Based on the Consolidation and Improvement Generated in the Previous Step</p> <p>现在请你结合刚才生成的“巩固提高”的内容和情境，分析和设计两道“统计”单元的“分层随机抽样”课的经典例题和对应的讲解教学活动，注意与“巩固提高”部分的前后衔接和问题链的设计。</p> <p>本节课讲授的新知识有：分层随机抽样或分层抽样、分层抽样的方法等，例题讲解的活动设计可以参考的教学方法有：合作学习法、复杂问题解决学习法、项目式学习法、分层分组学习法、混合式学习法、探究式教学法、迁移类比学习法等。</p> <p>请以详细教案的形式，设计详细的、具体的综合例题与变式练习。请在每个例题讲解活动后面提供可能的教学活动和设计意图。</p> <p>请不要超出知识内容进行设计。如果需要计算，请列出数学公式，并将数值代入公式使用插件计算。</p> <p>下面是内容格式：</p> <p>[综合例题1.1]: [解答提示1.1]: [变式练习1.2]: [解答提示1.2]: [教学活动和设计意图1]:</p> <p>[综合例题2.1]: [解答提示2.1]: [变式练习2.2]: [解答提示2.2]: [教学活动和设计意图2]:</p> <p>Referable Teaching Methods</p> <p>Design Intent of the Generated Questions</p> <p>Comprehensive Practice Phase: Zero-shot Generation Format Prompt Example</p> <p>Generation of Comprehensive Example Problems and Variant Exercises Based on the Problem Chain Scenario</p> <p>[综合例题1.1] 假设一个大型城市拥有10个区，每个区的人口不等。现在市政府希望对城市居民的生活质量进行调查，决定使用分层随机抽样的方法。假设每个区的人口数分别为A1, A2, ..., A10，如果市政府决定抽取总共1000个样本，应该如何决定每个区抽取的样本数量？</p> <p>Step-by-step Answer Hints</p> <p>[解答提示1.1] 分层随机抽样时，每层抽取样本的数量通常与该层在总体中的比例成正比。所以，每个区抽取的样本数量应该是该区人口数占总人口数的比例乘以总样本数。具体公式为：每个区抽取的样本数 = (该区人口数 / 总人口数) * 总样本数。</p> <p>[变式练习1.1] 如果市政府决定每个区都要抽取相同数量的样本，那么每个区应该抽取多少样本？</p> <p>[解答提示1.2] 如果市政府决定每个区都要抽取相同数量的样本，那么每个区应该抽取的样本数就是总样本数除以区的数量。具体公式为：每个区抽取的样本数 = 总样本数 / 区的数量。</p> <p>[教学活动和设计意图1] 通过具体的例题和变式练习，让学生了解分层随机抽样的操作方法，并理解在不同情况下如何决定每层抽取样本的数量。同时，这也提供了一个实际应用的场景，帮助学生更好地理解和掌握分层随机抽样的原理和方法。</p> <p>[综合例题2.1] 假设你正在进行一项关于全国中学生体质健康状况的研究，你计划在全国范围内随机抽取1000名中学生作为样本。考虑到全国各地的经济、文化、地理等条件的差异，你决定使用分层随机抽样的方法。你应该如何进行分层？并决定每层抽取样本的数量？</p> <p>[解答提示2.1] 首先，可以根据地理位置（如东部沿海地区、中部地区、西部地区）、经济发展水平（如一线城市、二线城市、三线城市、农村地区）或者其他需要进行分层。然后，每层抽取样本的数量可以根据该层在总体中的比例来决定。具体公式与问题1.1相同。</p> <p>[变式练习2.1] 如果你决定在每个省都抽取相同数量的样本，那么你应该在每个省抽取多少样本？</p> <p>[解答提示2.2] 如果决定在每个省都抽取相同数量的样本，那么每个省应该抽取的样本数就是总样本数除以省的数量。具体公式与问题1.2相同。</p> <p>[教学活动和设计意图2] 通过这个例题和变式练习，让学生理解在进行分层随机抽样时如何进行分层，并在分层的基础上如何决定每层抽取样本的数量。同时，这也是一个实际的研究情境，帮助学生了解分层随机抽样在实际研究中的应用。</p>
--	--

Fig.8 Comprehensive Exercise Phase Prompt Command and Generated Result Example

Table.7 Comprehensive Exercise Phase Prompt Command and Generated Result Example

Teaching Steps	Prompt Design & Question-Answer Examples
Comprehensive Exercise	<p>Prompt: Consolidation and Improvement + Lesson Name + Knowledge Points + Teaching Methods + Output Format (Comprehensive Examples and Variant Exercises)</p> <p>Question:</p> <p>Now, please combine the content and context of the previously generated "Consolidation and Improvement" section, analyze and design two classic examples for the "Statistics" unit's lesson on "Stratified Random Sampling" and their corresponding instructional activities. Pay attention to the linkages before and after the "Consolidation and Improvement" section and the design of the question chain.</p> <p>The new knowledge taught in this lesson includes: stratified random sampling or stratified sampling, methods of stratified sampling, etc. For the design of example explanation activities, you can refer to teaching methods such as cooperative learning, complex problem-solving learning, project-based learning, tiered grouping learning, blended learning, inquiry-based teaching, and transfer analogy learning.</p> <p>Please design in the form of a detailed lesson plan, detailing the integrated examples and variant exercises. After each example explanation activity, provide possible teaching activities and design intentions.</p> <p>Please do not design beyond the scope of the content. If calculations are needed, please list the mathematical formulas and input the values into the formulas using plugins for calculation.</p> <p>Here is the content format:</p> <p>[Integrated Example 1.1]: [Answer Hint 1.1]: [Variant Exercise 1.2]: [Answer Hint 1.2]: [Teaching Activity and Design Intent 1]: [Integrated Example 2.1]: [Answer Hint 2.1]: [Variant Exercise 2.2]: [Answer Hint 2.2]:</p>

	<p>[Teaching Activity and Design Intent 2]:</p> <p>Answer:</p> <p>[Integrated Question 1.1]: Suppose a large city has 10 districts, each with a different population. Now the city government wishes to survey the quality of life of its residents and has decided to use the stratified random sampling method. Assuming the populations of the districts are A1, A2, ..., A10 respectively, if the city government decides to draw a total of 1,000 samples, how should it determine the number of samples drawn from each district?</p> <p>[Answer Hint 1.1]: When performing stratified random sampling, the number of samples drawn from each stratum is usually proportional to its share of the overall population. Therefore, the number of samples drawn from each district should be the proportion of that district's population to the total population multiplied by the total number of samples. The specific formula is: Number of samples drawn from each district = (District's population / Total population) x Total number of samples.</p> <p>[Variant Exercise 1.2]: If the city government decides to draw an equal number of samples from each district, how many samples should each district draw?</p> <p>[Answer Hint 1.2]: If the city government decides to draw an equal number of samples from each district, then the number of samples each district should draw is the total number of samples divided by the number of districts. The specific formula is: Number of samples drawn from each district = Total number of samples / Number of districts.</p> <p>[Teaching Activity and Design Intent 1]: Through specific examples and variant exercises, students are introduced to the operation method of stratified random sampling, understanding how to determine the number of samples drawn from each stratum in different situations. This also provides a practical application scenario to help students better understand and master the principles and methods of stratified random sampling.</p> <p>[Integrated Question 2.1]: Suppose you are conducting a study on the physical health of middle school students nationwide and plan to randomly draw 1,000 middle school students as samples across the country. Considering differences in economy, culture, geography, etc., across the country, you decide to use the stratified random sampling method. How should you stratify? And determine the number of samples drawn from each stratum?</p> <p>[Answer Hint 2.1]: Firstly, you can stratify based on geographic location (e.g., coastal eastern region, central region, western region), economic development level (e.g., first-tier cities, second-tier cities, third-tier cities, rural areas), or other important factors. Then, the number of samples drawn from each stratum can be determined based on its proportion in the total population. The specific formula is the same as in Question 1.1.</p> <p>[Variant Exercise 2.2]: If you decide to draw an equal number of samples from each province, how many samples should you draw from each province?</p> <p>[Answer Hint 2.2]: If you decide to draw an equal number of samples from each province, then the number of samples each province should draw is the total number of samples divided by the number of provinces. The specific formula is the same as in Question 1.2.</p> <p>[Teaching Activity and Design Intent 2]: Through this question and variant exercise, students understand how to stratify when performing stratified random sampling and how to determine the number of samples drawn from each stratum based on the stratification. This also presents a practical research scenario, helping students recognize the application of stratified random sampling in real research.</p>
--	--

Prompt Based on the Pre-class Introduction, New Knowledge Explanation, and Consolidation Improvement Generated in the Previous Step

JM 现在请你结合刚才生成的“课前导入”、“新知讲解”、“巩固提高”环节内容，分析和设计“统计”单元的“分层随机抽样”课的“课堂小结”教学活动。本节课讲授的新知识有：分层随机抽样或分层抽样、分层抽样的方法等。“课堂小结”的设计形式可以参考但不限于：教师总结、学生小结发言、小组总结讨论、思维导图等。请以详细教案的形式，设计详细的“课堂小结”活动，并分点、精炼出本节课的知识内容。请不要超出知识内容进行设计。

下面是内容格式：

[教师活动1.1]:

[教师活动1.2]:

[本节课知识总结]:

Knowledge Content of This Lesson

Referable Lesson Summary Methods

Lesson Summary Phase:

Zero-shot Generation Format

Prompt Example

Classroom Summary Activities Generated by the LLM's Autonomous Selection

[教师活动1.1]: 邀请几位同学分享他们对今天课堂所学的理解和感想，包括分层随机抽样的概念、实施步骤及应用场景等。鼓励同学们以思维导图的形式进行总结和分享。

[教师活动1.2]: 在学生分享的基础上，教师做出补充和澄清，重点强调分层随机抽样的重要性和应用。教师可以借此机会解答学生在学习过程中可能产生的问题，并对学生在活动中表现出的优点和需要改进的地方给出反馈。

[本节课知识总结]:

Pointwise Summary of the Knowledge Content of This Lesson

- 分层随机抽样:** 分层随机抽样是一种抽样方法，它是将总体按照某种特征划分为几个互不重叠的子总体，然后从每一个子总体（即层）内部随机抽取样本，最后合并所有层内的样本作为最终的样本。
- 分层抽样的方法:** 分层抽样的方法主要有等量分层抽样和比例分层抽样两种。等量分层抽样是指在每一层内抽取相同数量的样本，而比例分层抽样是指在每一层内抽取的样本数量与该层在总体中的比例相同。
- 分层随机抽样的应用:** 分层随机抽样可以更好地反映总体的特征，提高抽样的效率和准确性。因此，它在社会调查、市场研究、教育评价等许多领域都有广泛的应用。
- 分层随机抽样的操作步骤:** 确定分层依据 -> 划分层 -> 决定每层抽样的样本数 -> 在每一层内进行随机抽样 -> 合并所有层的样本。

以上就是我们今天学习的内容，希望大家在课后能继续思考和实践，将所学知识运用到实际生活中。

Fig.9 Lesson Summary Phase Prompt Command and Generated Result Example

Table.8 Lesson Summary Phase Prompt Command and Generated Result Example

Teaching Steps	Prompt Design & Question-Answer Examples
Lesson Summary	Prompt: Pre-class Introduction + New Knowledge Explanation + Consolidation and Improvement + Lesson Name + Knowledge Points + Methods of Lesson Summarization + Output Format Question: Now, please integrate the previously generated contents from the "Introduction", "Explanation of New Knowledge", and "Reinforcement and Improvement" sections to analyze and design the "Class Summary" teaching activity for the "Stratified Random Sampling" lesson in the "Statistics" unit. The new knowledge taught in this lesson includes: stratified random sampling or stratified sampling, and methods of stratified sampling. The design forms for the "Class Summary" can refer to, but are not limited to: teacher's summary, student's summary speech, group summary discussion, mind maps, etc. Please design the "Class Summary" activity in a detailed lesson plan format and outline the knowledge content of this lesson point by point. Please do not exceed the scope of the knowledge content in your design. Here is the content format: [Teacher Activity 1.1]: [Teacher Activity 1.2]: [Summary of Knowledge from this Lesson]:
	Answer:
	[Teacher Activity 1.1]: Invite several students to share their understanding and feelings

	<p>about what they have learned in today's class, including the concept of stratified random sampling, its implementation steps, and application scenarios. Encourage students to summarize and share in the form of mind maps.</p> <p>[Teacher Activity 1.2]: Based on the students' sharing, the teacher will supplement and clarify, emphasizing the importance and application of stratified random sampling. The teacher can take this opportunity to answer questions students might have had during the learning process and provide feedback on students' strengths and areas for improvement demonstrated in the activity.</p> <p>[Summary of Knowledge from this Lesson]:</p> <p>(1) Stratified Random Sampling: Stratified random sampling is a sampling method where the population is divided into several non-overlapping sub-populations based on certain characteristics. Samples are then randomly selected from each sub-population (i.e., stratum), and all samples from the strata are combined as the final sample.</p> <p>(2) Methods of Stratified Sampling: The main methods of stratified sampling are equal-size stratified sampling and proportional stratified sampling. Equal-size stratified sampling refers to drawing the same number of samples from each stratum, while proportional stratified sampling means that the number of samples drawn from each stratum is proportional to that stratum's size in the overall population.</p> <p>(3) Application of Stratified Random Sampling: Stratified random sampling can better reflect the characteristics of the overall population, improving the efficiency and accuracy of sampling. As a result, it is widely used in many fields such as social surveys, market research, and educational evaluations.</p> <p>(4) Operational Steps of Stratified Random Sampling: Determine the basis for stratification -> Divide into strata -> Decide the number of samples for each stratum -> Randomly sample within each stratum -> Combine the samples from all strata.</p>
--	--