

Case Study On Statistics Lessons by High School Mathematics Teachers 高中数学教师统计教学课例研究

Xie YangChun 谢阳春

The Affiliated High School of Gannan Normal University

赣南师范学院附属中学

xieyangchun.03.08@163.com

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Problem Statement 问题的提出

- Ten Core Concepts in the Mathematics Curriculum Standard for Full-time Compulsory Education (experimental) set by Chinese Ministry of Education in 2011 (Huang Xiang, 2012) are:
- 2011年中国教育部制定的《全日制义务教育数学课程标准（实验）》提出了10个核心概念（黄翔，2012）：
- Number sense, symbol consciousness, space idea, geometric intuition, data analysis idea, operation ability, reasoning ability, model thinking, application consciousness, innovation consciousness
- 数感、符号意识、空间观念、几何直观、数据分析观念、运算能力、推理能力、模型思维、应用意识、创新意识
- There is no reference to the core concepts in this standard
- 在这个标准中没有“核心概念”的提法

Problem Statement 问题的提出

- It was put forward in the Mathematics Curriculum Standard for Ordinary High School (Experimental) by Chinese Education Ministry in 2003 that:
- With the core concepts and basic ideas running through the entire teaching, teachers should help students gradually deepen their understanding
- 2003年中国教育部制定的《普通高中数学课程标准（实验）》中提出：教师在教学中，对一些核心概念和基本思想要贯穿教学的始终，帮助学生逐步加深理解
- In this standard, there is the idea of "core concept", but no specific list of what the core concepts are
- 在这个标准中，有“核心概念”的提法，但是没有列举出具体有哪些核心概念

Research Questions 研究的问题

- What are the core concepts of high school mathematical statistics?
- What is the connotation of data analysis concept?
- What is the relationship between the core concepts and the data analysis concept?
- What is the current situation in core concept teaching in high school mathematics statistics class?
- 高中数学统计的核心概念有哪些
- 数据分析观念的内涵是什么
- 核心概念与数据分析观念之间是什么关系
- 高中数学统计课堂里的核心概念教学现状是怎样

Reviewing the literature 文献综述

- Concept map is a kind of teaching strategy put forward by Joseph (Joseph D. Novak of Cornell University) according to the meaningful learning theory of Ausubel (David P. Ausubel). The basic idea is to use nodes to represent concepts, lines to represent the connection of the concepts. The basic step is to list knowledge first, then determine the level of the knowledge, and at last establish hierarchy connection. (Zhang Jianyue, 2013)
- 概念图（concept map）是美国康奈尔大学的诺瓦克（Joseph D. Novak）根据奥苏贝尔（David P. Ausubel）的有意义学习理论提出的一种教学策略，基本思路是用节点代表概念，用连线表示概念间的联系，基本步骤是先列举知识点，再确定知识等级，然后建立层级连接（章建跃，2013）

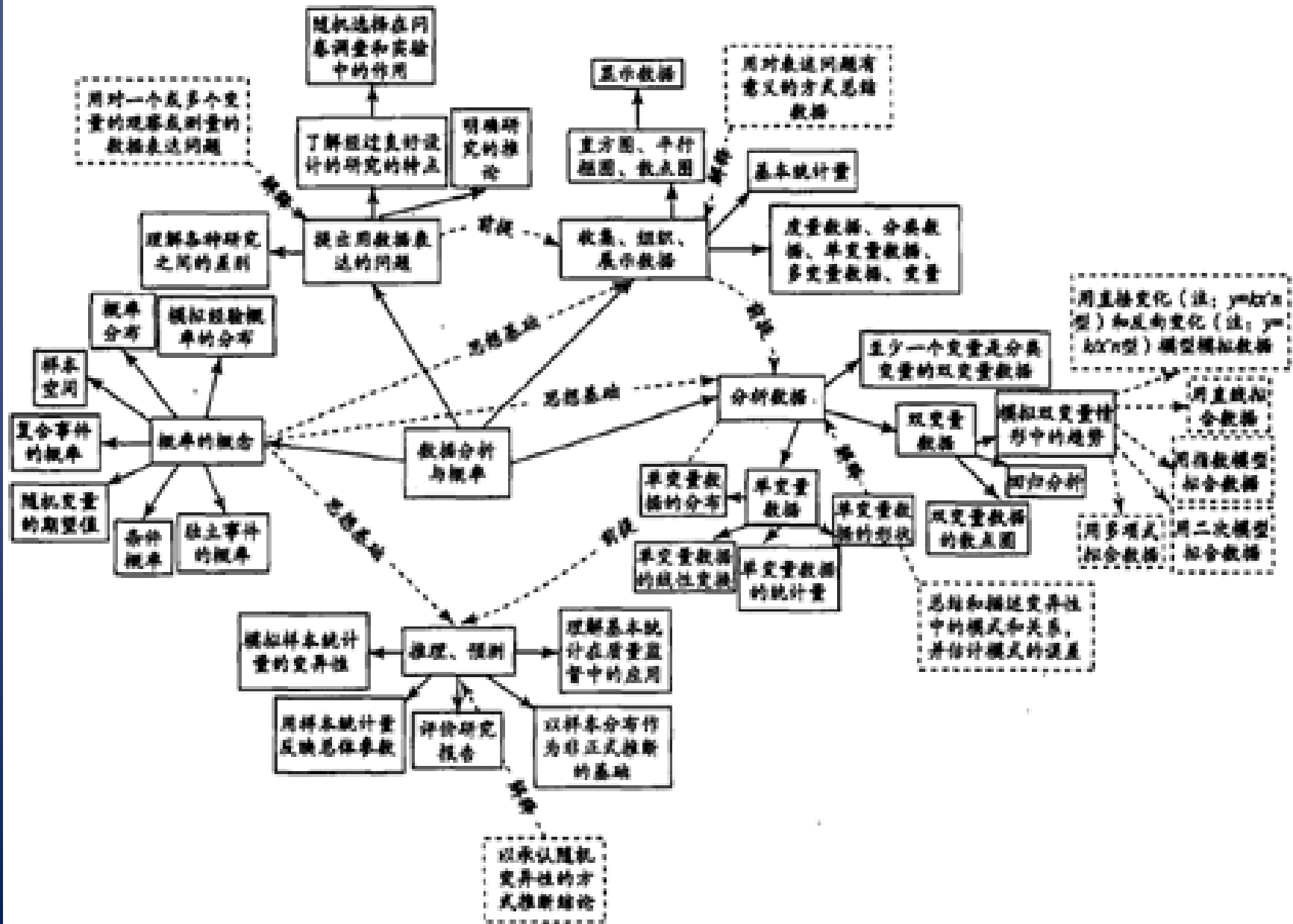
Reviewing the literature 文献综述

- The core of learning does not refer to any specific knowledge, not even the knowledge itself, instead it sums up the common ideas and ways of thinking reflected by the generality of much knowledge, the core word of statistics being **data analysis** (Shi Ningzhong, 2008)
- 学习的核心内容不是指具体的知识点，甚至不是指具体的知识本身，而是概括很多知识的共性所反映出来的思想和思维方式，统计的核心词就是数据分析（史宁中，2008）
- American curriculum expert Erickson believes that the core concept, being in the center of the subject, is a key concept, principle and method which has a long-lasting value and transfer value beyond the classroom.
- 美国课程学家埃里克森（Erickson）认为,核心概念是居于学科中心，具有超越课堂之外的持久价值和迁移价值的关键性概念、原理和方法（埃里克森，2003）

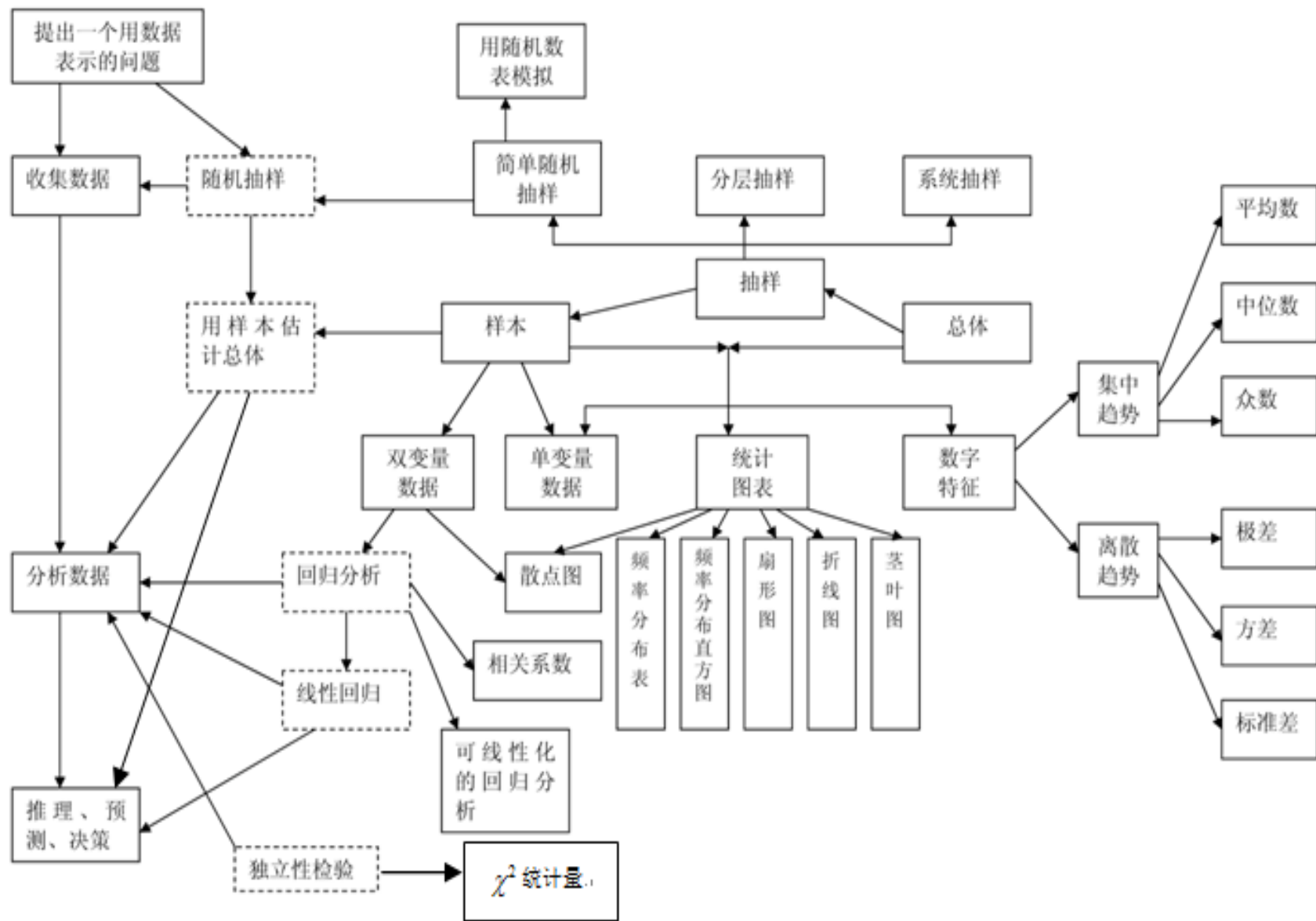
Reviewing the literature 文献综述

- With the UCSMP(University of Chicago School Mathematics Project) series textbooks as reference, Zhang Jianyue and his team, after studying the School Mathematics Education Principles and Standards for Grades 9 to 12 issued by American National Council of Teachers of Mathematics (NCTM) in 2000, drew the core concept map of American high-school mathematics (Zhang Jianyue, Song Lili, Wang Rong, Zhou Dan, 2013)
- 章建跃等在研究了美国国家数学教师理事会（NCTM）于2000年发布的《学校数学教育的原则和标准》中9至12年级的内容标准，以及参考了美国芝加哥大学编写的UCSMP(University of Chicago School Mathematics Project)系列教科书之后，绘制了美国高中数学的核心概念图（章建跃，宋莉莉，王嵘，周丹，2013）
- Using statistical activities as the main line, namely: presenting a data-represented problem, collecting data, analyzing data and reasoning
- 以统计活动为主线，即：提出一个用数据表示的问题、收集数据、分析数据、推理预测

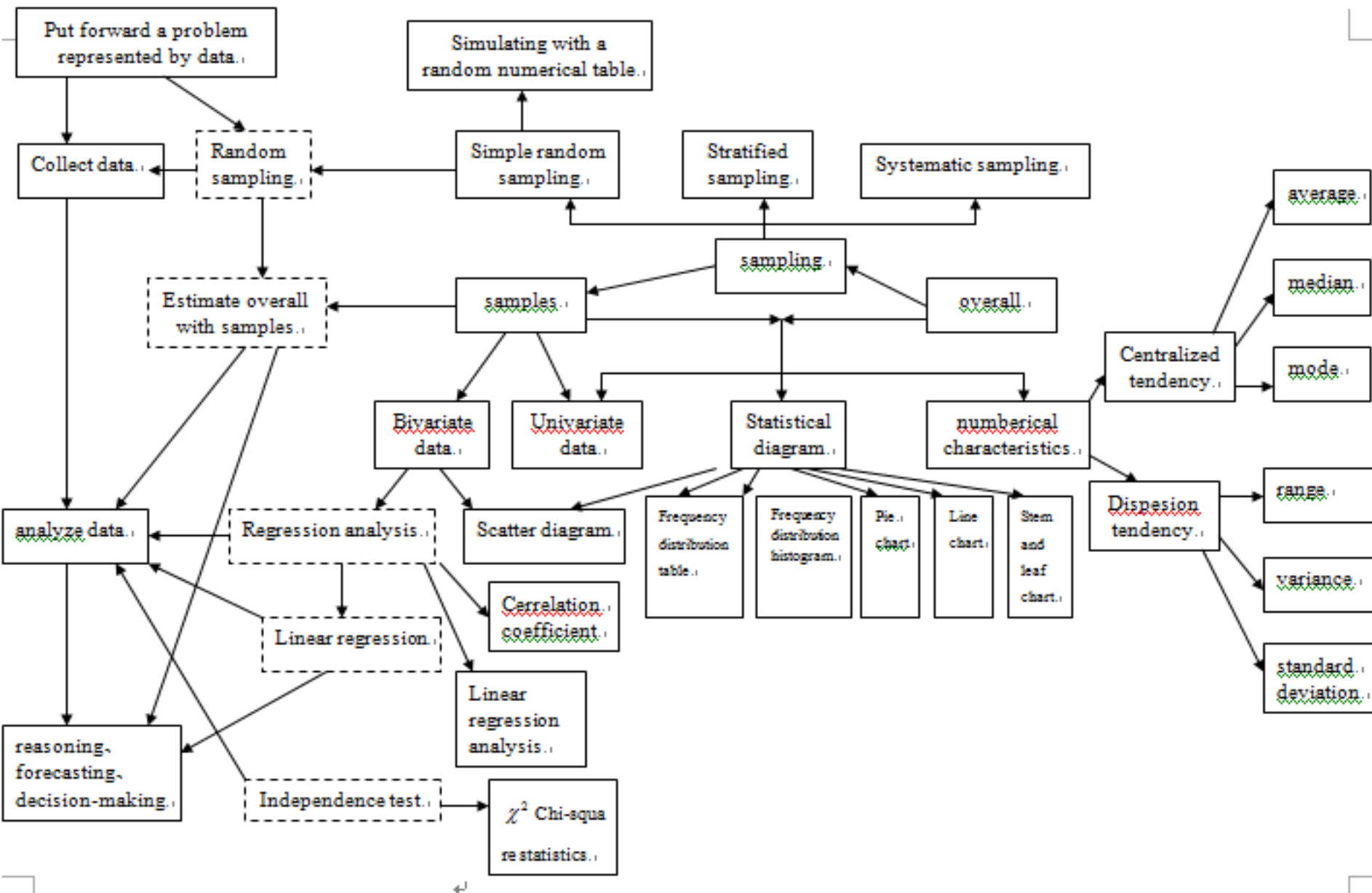
美国高中数学数据分析与概率的核心概念图 (章建跃, 宋莉莉, 王嵘, 周丹, 2013)



北师大版高中数学统计的核心概念图



The core concepts of senior high school mathematical statistics (textbooks published by Beijing Normal University Press in 2008)



Summary小结

- The core concept of the high school mathematical statistics is based on the idea of data analysis, that is, random sampling, estimating overall with samples, regression analysis, linear regression, and independent test.
- 高中数学统计的核心概念是以数据分析的思想方法为主线，即：随机抽样、用样本估计总体、回归分析、线性回归、独立性检验

Research Method 研究方法

- Research Site 研究场所
- Participants 参与者
- Research Method Design 研究方法设计
- Data Collection 数据收集
- Instrument 测试手段
- Data Analysis 数据分析

Research Method 研究方法

Research Site 研究场所

Two municipal key high schools in City G in the south of Jiangxi Province

江西省南部G市的两所市级重点高中

Two science classes of grade two, senior high school
高二理科的两个班级

Participants 参与者

Teacher W and Teacher M

任课教师W教师和M教师

Research Method 研究方法

- Research Method Design 研究方法设计
- The establishment of the research framework draws on Wen Fangyong's "teaching model of the core concept of mathematics" (Wen Fangyong, 2013)
- 本研究框架的建立借鉴了温芳勇的“数学核心概念的教学模式表”（温芳勇，2013）
- Part of the observed **teaching phenomenon** can be referred to the study result of Wu Hua and Zhou Ming (2003)
- 部分可观察的教学现象还借鉴了（吴华，周鸣，2013）的研究结果

Research Method Design 研究方法设计

		教学现象 Teaching phenomenon	1	2	3	4	5	6	7
A操作阶段 The action stage	a1	从概念的产生背景 From the emergence background of the concept							
	a2	从实际需要引入 Introduce from practical need							
P过程阶段 The process stage	b1	通过实例进行抽象 Abstract by examples							
	b2	通过正例加深理解 Deepen understanding through positive examples							
	b3	通过反例帮助理解 Help understanding through negative examples							
	b4	改变约束条件 Change the constraint							
	b5	通过比较加深理解 Deepen understanding through comparison							
	b6	给出概念名称 Give concept name							
O对象阶段 The object stage	c1	用形式化的符号来表达概念 Use formal notation to express concepts							
	c2	揭示特征 Reveal features							

		教学现象 Teaching phenomenon	1	2	3	4	5	6	7
A操作阶段the operation stage	a1	从概念的产生背景 From the emergence background of the concept							
	a2	从实际需要引入 Introduce from practical need							
P过程阶段 The process stage	b1	通过实例进行抽象 Abstract by examples							
	b2	通过正例加深理解 Deepen understanding through positive examples							
	b3	通过反例帮助理解 Help understanding through negative examples							
	b4	改变约束条件 Change the constraint							
	b5	通过比较加深理解 Deepen understanding through comparison							
	b6	给出概念名称 Give concept name							
O对象阶段	c1	用形式化的符号来表达概念							

Data Analysis 数据分析

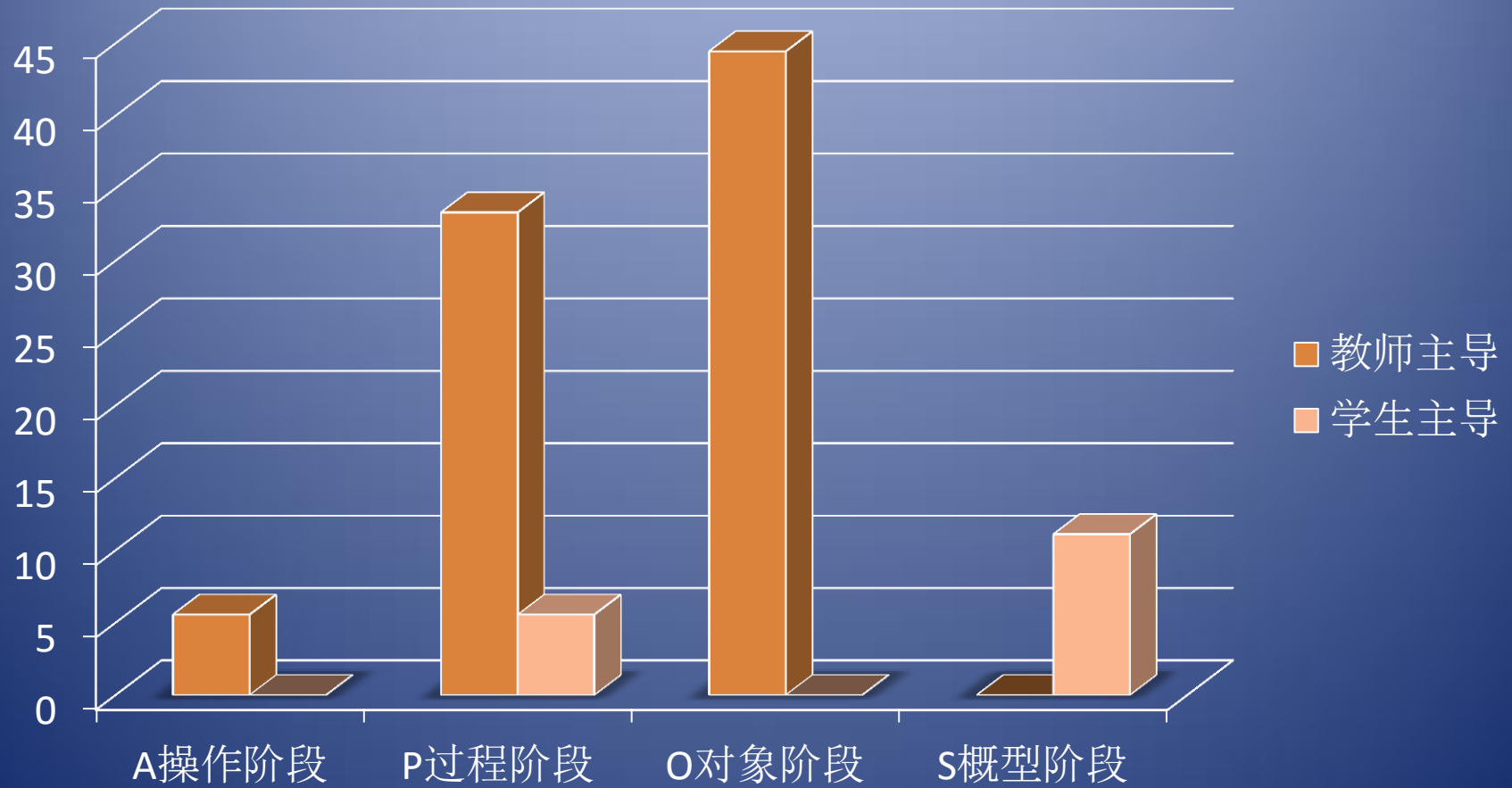
W教师

M教师

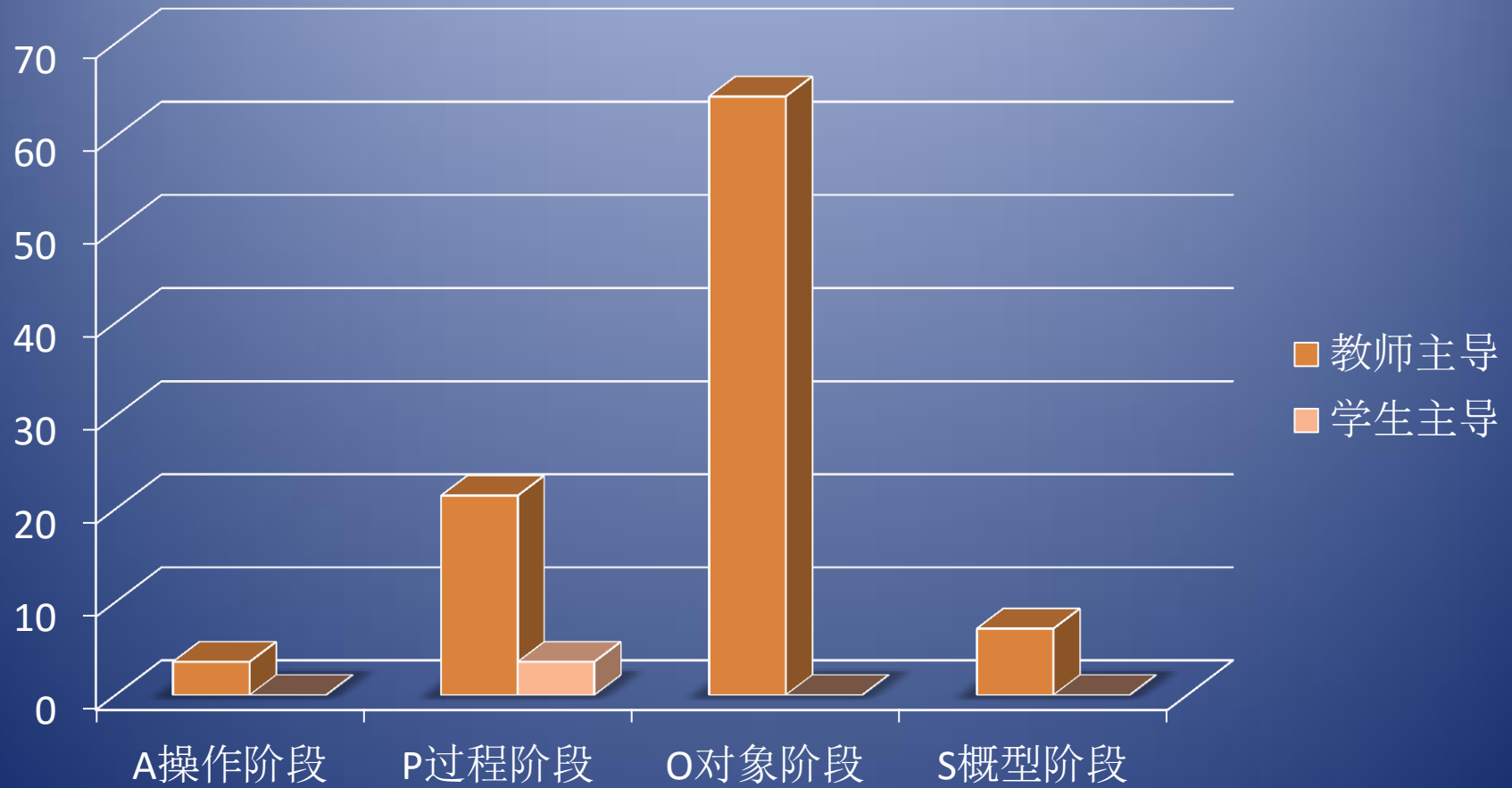
		A 操作 阶段	P 过程 阶段	O 对象 阶段	S 概型 阶段	合计
教师 Teacher	次数 Number	1	6	8	0	15
主导 leading	占比 percentage	5.56%	33.33%	44.44%	0	83.33%
学生 Student	次数 Number	0	1	0	2	3
主导	占比	0	5.56%	0	11.11%	16.67%
合 total	计	1	7	8	2	18

		A 操作 阶段	P 过程 阶段	O 对象 阶段	S 概型 阶段	合计
教师	次数	1	6	18	2	27
主导	占比	3.57%	21.43%	64.29%	7.14%	96.43%
学生	次数	0	1	0	0	1
主导	占比	0	3.57%	0	0	3.57%
合 计		1	7	18	2	28

W教师



M教师



Cumulative precentage of four stages

两位教师四阶段累计百分比

	A操作阶段 Action stage	P过程阶段 Process stage	O对象阶段 Object stage	S概型阶段 Scheme stage
W教师	5.56%	38.89%	83.33%	100%
M教师	3.57%	25.00%	89.29%	100%

Conclusion and Suggestion

研究结论与建议

- On the present situation of Statistics Teaching of senior high school mathematics teachers
- 关于高中数学教师统计课堂教学现状
- On the core concepts of senior high school mathematical statistics (textbooks published by Beijing Normal University Press in 2008 as an example)
- 关于高中数学统计的核心概念（以2008年北京师范大学出版社出版的教材为例）
- On data analysis concepts and the relationship between data analysis concepts and the core concepts in statistics
- 关于数据分析观念以及数据分析观念与统计的核心概念之间的关系

关于高中数学教师统计课堂教学现状
(以江西省南部G市的两所重点中学为例)

On the present situation of Statistics Teaching of senior high school
mathematics teachers

(Two municipal key high schools in City G in the south of Jiangxi Province as
an example)

- High school mathematics teachers are still playing a leading role in the statistics class. The opportunities for students to lead the class are acquired by answering the teacher's questions, or by doing classroom exercises. The average number of teaching phenomenon which is dominated by the teacher is 89.88%, and the average level of the students is 10.12%
- 高中数学教师仍旧在统计课堂中起主导作用，学生主导课堂的机会是通过回答教师的提问的方式获得，或者是以做课堂练习的方式获得。由教师主导的教学现象次数平均占整节课出现的教学现象次数的89.88%，学生的平均水平是10.12%

关于高中数学教师统计课堂教学现状 (以江西省南部G市的两所重点中学为例)

- There is a phenomenon that high school mathematics teachers simplify the procedures when they are deducing and analyzing statistical concepts and formulae, attaching no importance to the deducing process of concepts, formulae and rules, which, in turn, may lead to the students' failure of really understanding relative formulae and statistical way of thinking. The cause of it may be attributed to the fact that the teachers lack opportunities to re-study and re-train statistical knowledge and the textbooks are too simply compiled.
- 高中数学教师在统计概念和公式的推导分析过程中存在简单化处理的现象，没有重视概念与公式以及规则的推导分析过程，这可能会导致学生无法真正理解统计的有关公式和统计的思想方法。造成的原因与教师缺乏统计知识的再学习和培训，以及教材的编写过于简单存在一定的关系。

On data analysis concepts and the relationship between data analysis concepts and the core concepts in statistics

关于数据分析观念以及数据分析观念与统计的核心概念之间的关系

- Data analysis concept is a cognitive system in which the core concepts and methods of statistics are integrated.
- 数据分析观念是一个综合了统计的核心概念和思想方法的认知体系。
- The establishment of data analysis concept and the statistical core concept learning are relevant. First of all, we need to grasp the core concepts of the four processes of statistics (i.e., putting forward data-related problems, collecting data, analyzing data, reasoning and forecasting), then we need to understand the basic ideas of statistics.
- 数据分析观念的建立和统计的核心概念的学习是有关的。首先需要掌握统计的四个过程（即提出和数据有关的问题、收集数据、分析数据、推理预测）的核心概念；其次需要理解统计的思想方法

谢谢各位！
Thank you!

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