

# **Application and Evaluation of PBL Model in Biochemistry**

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# OUTLINE

- Background and Significance
- Preparation
- Implementation
- Evaluation
- Summary

# Background

- PBL has become a worldwide accepted strategy for medical education for over 40 years.
- CMB (China Medical Board) has established a program to promote the PBL curriculum in China.
- The major objective of this program is to train medical professionals of high quality which is in good alignment with the international standard of GMER (Global Minimum Essential Requirements in Medical Education).

# PBL in CMU

- CMU has initiated the PBL program 5 years ago in order to match the GMER's standard.
- The PBL program in CMU covered a broad spectra of medical education from fundamental science of medicine to clinical training.
- The course of Biochemistry and Molecular Biology is one of the essential components of basic science, which furnishes the knowledge and skills to students.

# Knowledge and Skills

- **Knowledge:** To use the concepts and principles to interpret the causes, development and progression of diseases at the molecular level
- **Skills:** To search possibilities for disease prevention, diagnosis and treatment, to acquire and analyze the information of patients, and to provide rational treatment plans and long-term health care options

# PBL Planning

- The success of the PBL implementation in China presents a great challenge due to the traditional Asian culture and Chinese education system.
- The current situation of students and tutors were analyzed.
- The PBL plan in biochemistry course was designed accordingly.

# Asian Culture

- **Social respect:** respect to the authority and senior
- **Educational environment:** already used to the teacher-centered setting for a long time
- **Academic outcomes:** always expectation for higher scores
- **Psychological impact:** fears of failures

# Students' Reality

- The course of Biochemistry and Molecular Biology is taught in the 2nd year of 5-ys or 7-ys system.
- Very limited knowledge of medicine, no intuitive feeling about clinical observation, no direct contact with patients
- Lacking the ability to analyze the available evidence, to conduct self-directed study, to find the key points to solve problems

# Challenge to Tutors

- Understand the true meaning of PBL
- Knowledge preparation: need to know more than just biochemistry and molecular biology (cell biology, immunology, medical genetics, physiology, and something in clinical medicine)
- Effective communication skills
- Identify the true problems during the group discussion, and take a lead appropriately

# Understanding PBL

- the problem-based learning rather than case study in clinical training, using the fundamental knowledge to interpret the clinical observations at the molecular and the cellular levels
- the enhancement of abilities (critical thinking, self-directed study, ...) rather than the increased test scores
- the training process rather than the training outcomes

# Three-Phase PBL Process

- **1st:** Properties and structures of biomolecules
  - Preparation for the PBL approach
- **2nd:** Metabolism of materials
  - Pure problem-based learning
- **3rd:** Genetic information flow
  - Hybrid PBL form
- 25 class hrs for each phase

# Formal PBL Paradigm

- Self-study and group study for the given questions
- Tutor-guided group discussion
- Class presentation

# Case Selection

	Symptoms	Relevant topics
1	High blood glucose	glycolytic pathway, anaerobic oxidation, gluconeogenesis
2	High urine glucose	fat mobilization, generation of ketone bodies, $\beta$ -oxidation
3	High cholesterol	Cholesterol metabolism, phospholipids metabolism
4	Losing weight	Nitrogen balance, amino acid metabolism

# PBL Facilitation

- Listed 80 relevant questions to guide student self-directed study
- Provided reading materials for student study (textbooks, summary notes, introductory readings, journal articles, min-reviews, ...)

# Student Grouping

- Conducted PBL 3 times
- Randomly selecting ~150 students. 75 as control, 75 as experimental: ~15 students/group (in comparison with ~ 7 in USA and ~10 in UK)
- The 1st and the 3rd parts were taught together in a big classroom, and the 2nd part was taught separately.

# Group Discussion



# Group Discussion



# Class Presentation



# Class Presentation



# Tutor's Roles in the class

- Keep the discussions in the right direction
- Promote students' interest and enthusiastic
- Avoid students to simply repeat or copy the words from the textbooks and resources
- Focus on the “must-know” of biochemistry, and avoid being involved in clinical details too much
- Exchange experience, students' response, discussion organization, unpredicted topics and questions which need attention, ...

# Hybrid PBL format

- Self-study and group study for the given questions
- Tutor-guided group discussion
- Instant class questioning
- Class presentation
- Homework
- Reading assignments

# Evaluation

- **Qualitative:**
  - Standard questionnaire sheet
  - Feedback information from students and tutors
- **Quantitative:**
  - Using the “challenging” questions to assess the problem-solving ability
  - Statistical analysis of the scores

# Positive Results

- Significantly improved the student ability to think critically, to search, organize and analyze information, to communicate effectively, to identify and solve problems independently, ...
- Motivated to self-directed study
- changed the mindset of “teach-learn” to “learn-discussion-learn”, benefiting the student study

# Quantitative Analysis

	Challenging questions	total questions
experimental	3.57 (8)	76.3 (100)
control	2.61 (8)	71.9 (100)
T test statistic significance	$P = 0.1546 > 0.05$ no	$P = 0.000054 < 0.01$ yes

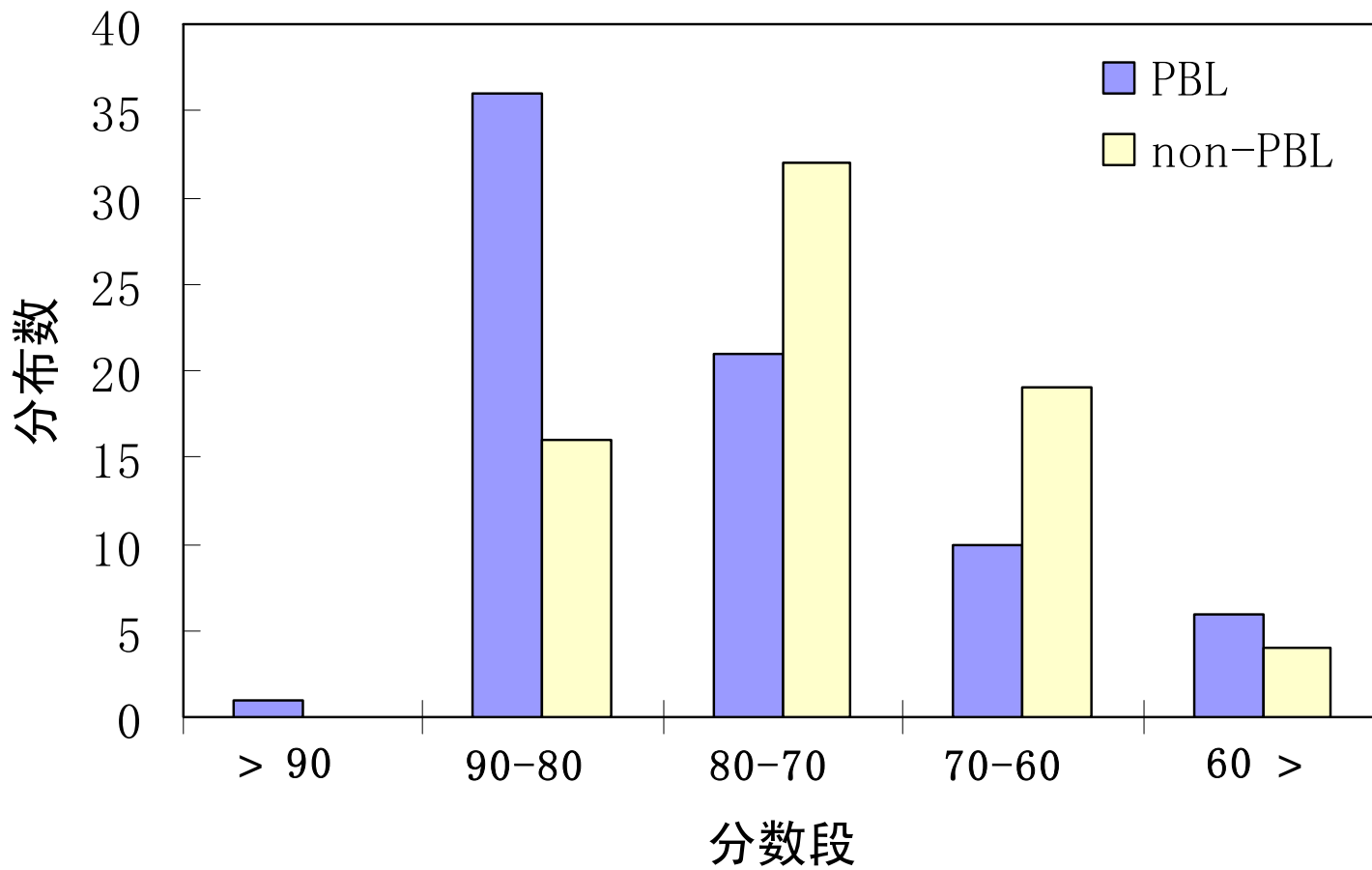
# Score Distribution

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	> 90	90-80	80-70	70-60	< 60
<b>experimental</b>	1	36	21	10	5
<b>control</b>	0	16	32	19	4

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### 分数分布图



# To be improved

- Students:
  - Two extremes
  - Labor-intensive, time-consuming
  - Knowledge segregation
  - Easily lost
  - The infrastructure and facilities need to improve to satisfy the need of the PBL environment.

# To be improved

- Tutors:
  - Some selected cases are not suitable for the relevant knowledge
  - Limited resources
  - Various levels
  - Infrastructure and facility (internet, library, ...)
  - Standards for objectively assessing outcomes
  - A long-term program for follow-up evaluation

# Summary

- The practice of PBL in CMU has proved to be an effective approach for high quality medical education.
- Students demonstrate the increased ability in many aspects.
- Some procedures are needed to improve the effectiveness of PBL.
- A long-term and systematic PBL program should be established (planning, execution, evaluation).

**Thank you  
for your attention**

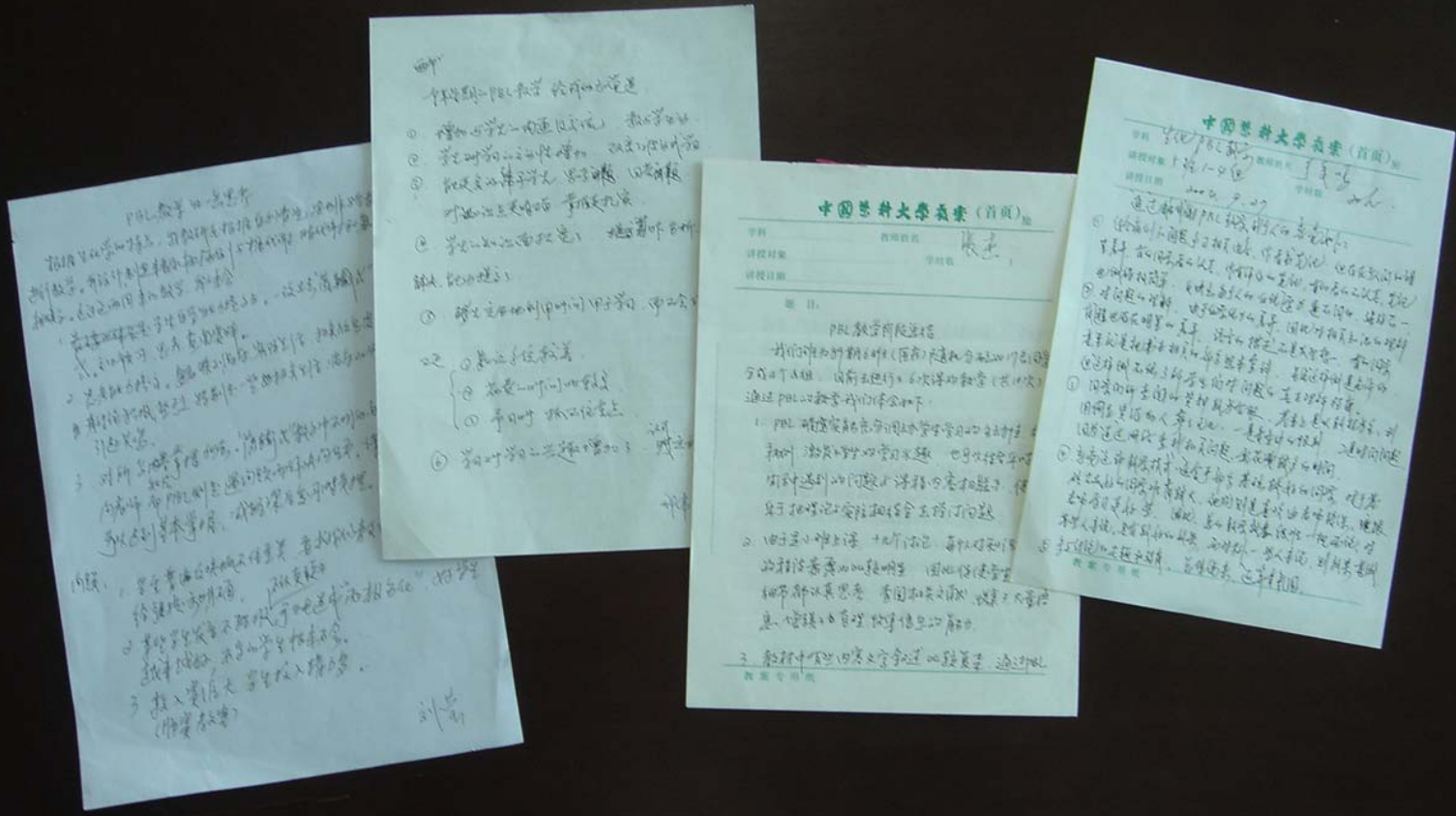
# 7 criteria of GMER

- Professional value, attitudes, behavior and ethics
- Scientific foundation of medicine
- Communication skills
- Clinical skills
- Population health and health system
- Management of information
- Critical thinking and research

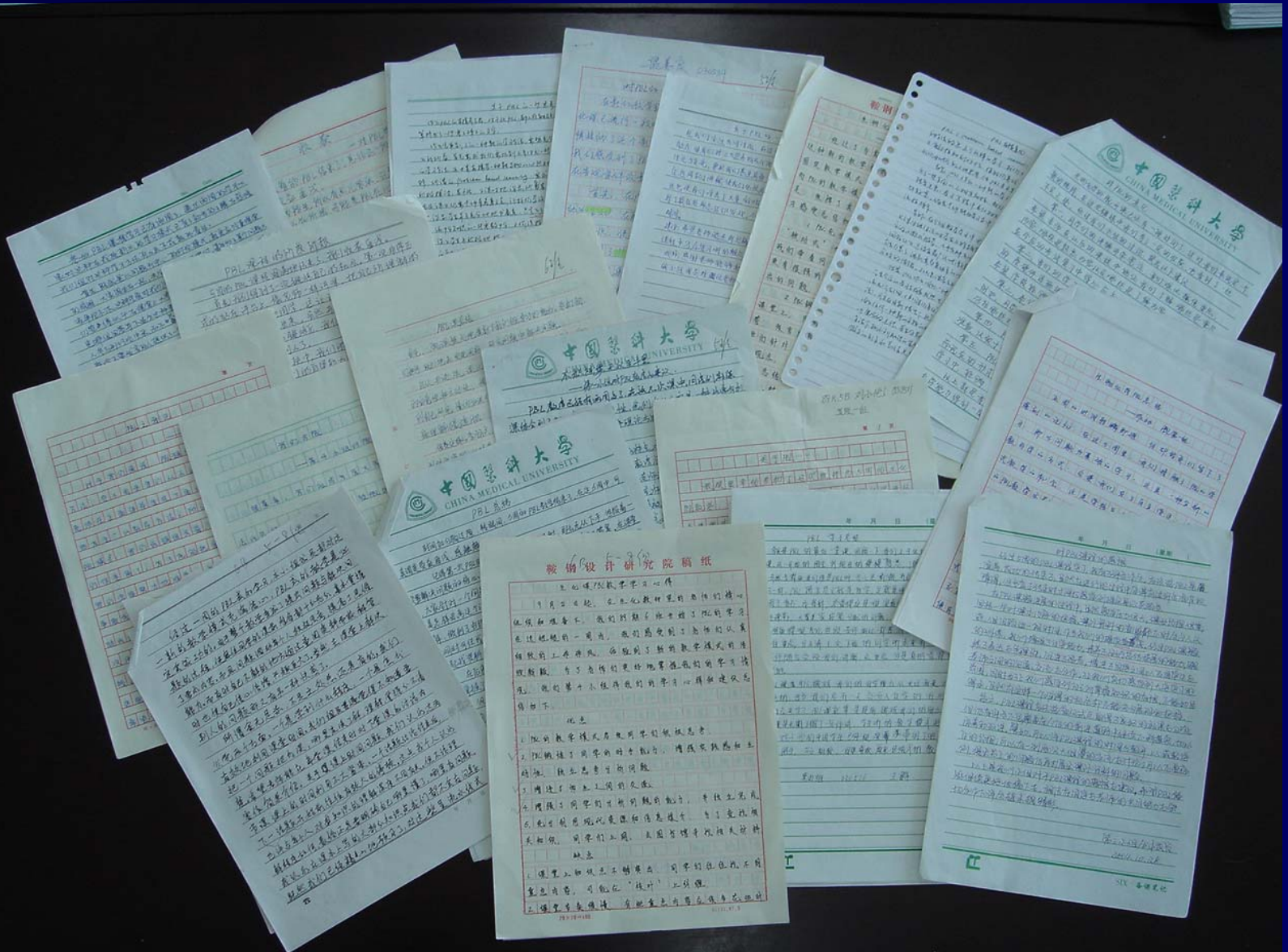
# Case Selection

- Selected 4 typical clinical cases to cover the section of material metabolism (sugars, lipids and amino acids)
- Metabolism is one of the three parts of biochemistry, well defined and in the middle of the course.
- This part accounts for about one third of biochemistry in terms of the content and the class hour.

# Feedback Information



# Feedback Information



# Instant Class Questioning

