

Analysing and improving teaching based on a random sample investigation

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ABSTRACT: The teacher-oriented universities in China provide training for personnel in education. The training process directly affects the results gained from teaching. Therefore, reform is particularly important to this type of university. First, the study described in this article, is of a random sample investigation of the teaching process using a sample of students; and an analysis of the results is presented. Note that the statistical measure used in this study was also applied to a seeds resource investigation of the deciduous tree, *Acer mono Maxim*. Second, the results could be applied to a design of a new course; and a test of the design was made. Analysis shows that the sampled students' final grades have generally increased and that the main performance indicators of students' ability also have improved. Consequently, the conclusion is that the innovative design for teaching has improved the teaching process.

INTRODUCTION

In 1968, the American scholar Robert M. Hutchins for the first time put forward the concept of a *learning society* [1]. In 1972, the ICDE (International Council for Open and Distance Education), in UNESCO (United Nations Educational, Scientific and Cultural Organization) issued the report, *Learning to be: the World of Education Today and Tomorrow*. The report is also known as the *Faure Repoa* [2]. The report lists the ultimate goals of education as: learning to know, learning to do, learning to live together or learning to live with others, as well as learning to be.

Canadian scholar Abram G. Konard emphasised that education is learning rather than teaching. The future society is a learning society, and all its members should adhere to lifelong learning and lifelong education [3]. The opinion, in *Innovative Discipline*, of well-known American educationist Dr Merrill Harmin is that a good class should be encouraged [4]. Under this *light and energetic atmosphere, learners have clear dignity, autonomy, collective feelings and good sense, together with the control of their own thoughts and feelings* [4].

The well-known learning software designer Marc Prensky, North Carolina State University, put forward the concept of *Digital Natives* and *Digital Immigrants* [5]. To him, the current generation of students are Digital Natives, and this generation of students has grown up in the digital age from their birth. The concept of *digital* changes their ways of thinking, further making their abilities fundamentally different from earlier ones in thinking and processing information. There are many discrepancies between *Digital Immigrant* teachers and *Digital Natives* students, in learning style, preferences and skills. The gap between them is the biggest problem faced by current education [5]. The random sample investigation method used in this study is a mature tool, with wide application in fields of social science and natural science, e.g. a resources survey on the seeds of the deciduous tree, *Acer mono Maxim*.

With nearly 10 years' rapid development, China's higher education has stabilised. However, reviewing a teaching-oriented university in China, it was found there are still some disadvantages in the existing teaching process, such as dogma, stasis, monotony and stereotyping. Under this traditional classroom atmosphere, the students lack interest in learning. Chinese education has not tended to develop innovation. Results from *Mr Qian's Question* to the 2009 world rankings by the International Evaluation Organisation (IEO) of students' imagination and creativity in 21 countries, reflect Chinese children's lack of questioning, imagination and creativity [6]. This requires that education be reformed as soon as possible to suit the country's needs. The traditional teaching process at university must be reformed.

In today's debate about education, the most basic point is that China's educated students are changing fundamentally and that traditional teaching is no longer adequate. Scholars review the theory of education but few pay attention to targeting improvements in teaching. The aim of this study was to design a scientific teaching process for the rationalisation of teaching outcomes.

Outlined in this article is the design of teaching based on teaching theories of knowledge visualisation [7][8]; active teaching [9]; effective teaching and learning [10]; and creative thinking [11]. These were created to encourage students' active learning and to inspire them to interact with their teachers. This new innovative teaching process has resulted in a general improvement, which is borne out by the final test grades. The students' creative thinking and learning skills also have improved through this interactive teaching [12].

STATISTICAL ANALYSIS OF IN-CLASS CHARACTERISTICS

The main eight characteristics of teaching have been selected to design a questionnaire viz. priority in lecture, vividness, teacher-student interaction, heuristic thinking, openness, strictness, freedom, richness in practice and one open option. Each respondent chose the four most important characteristics in the teaching. After distributing a random questionnaire to 500 students at Beihua University, the statistical results were as follows:

Table 1: Statistical analysis of the investigation of in-class characteristics.

The characteristics of the class	Person-time	The percentage (%)	Rank
Priority in lecture	73	14.6	7
Vividness	471	94.2	1
Teacher-student interaction	326	65.2	3
Heuristic thinking	379	75.8	2
Openness	155	31	6
Strictness	207	41.4	5
Freedom	32	6.4	9
Richness in practice	301	60.2	4
Open	55	11	8

The above statistics led to the conclusion that the four characteristics students prefer are: vividness, heuristic thinking, teacher-student interaction and richness in practice. The following teaching process was designed based upon these conclusions.

TEACHING DESIGN

The design should focus on cultivating students' awareness [13]; their knowledge and their personal needs [14], so as to make full use of the on-line environment; a comfortable physical learning environment and a good learning support system [15]. Theories involved include knowledge visualisation, active teaching, effective teaching and learning, and creative thinking. The various parts are:

Preparation: preparation provides the base for teaching. The teacher must prepare the teaching for the course such that the proper resources in teaching and learning are obtained, as well as to point out the key learning outcomes for the students. The teacher can create a *guide map* using mind mapping tools, such as Mindmapper, Inspiration and MindManager. This is conducive to clarifying the relationship among different parts of the course. Students at the preparation stage mainly complete their tasks using *maps* prepared by the teacher. Additionally, they can raise any problems and question the teacher or other students in subsequent classes.

(Knowledge) Visualisation: at the beginning of teaching, a method called *situational introduction* can be used to encourage students to learn and absorb knowledge. With the aid of visual classroom displays and audio systems, an atmosphere conducive to student learning can be provided. The teacher can carry out a preparatory test of the students. The test determines a student's initial level of knowledge. The teacher can adjust the teaching *start point*, according to the students' initial level of knowledge.

(Knowledge) Instruction: teaching design is based on the analysis of the important and/or difficult parts of the course. The teacher should present in class the important and difficult segments. The focus should be to ensure that complete knowledge has been transferred. Students should make note of major points, to make recall of the main points of the lesson easier.

Questioning: through individual and group discussion, students should explore the questions raised. Tasks should be assigned to teams. Each group of students should argue through their questions. In the process of exploration, the teacher should be guided by the students' needs. In group learning, the teacher should solve problems in class, and participate in group discussion.

Teacher-student interaction: the teacher should organise groups and select a *class representatives* group. This group explores the finished work, including the issues raised by these questions, e.g. what are your questions? How to solve your questions? What are your results? The teacher and the classmates review and report on the completed work.

Thinking or reviewing-after-class: according to the results of the evaluation of their learning, the teacher has the opportunity of giving students, who will be at different learning levels, a specific task to do. After class, both teacher and students can rethink their teaching or learning process or experience, and can draw conclusions on the advantages and disadvantages. The stages of the teaching process are shown in Figure 1 below.

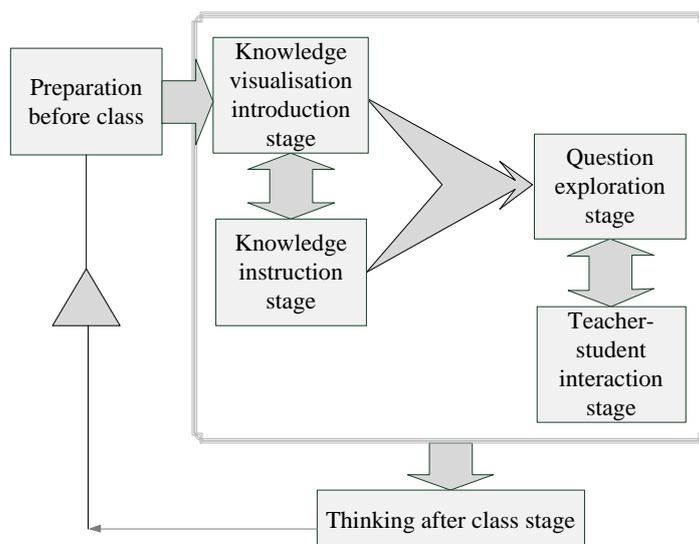


Figure 1: The new process of teaching in class.

RESULTS AND DISCUSSION

Assessment of Teaching

Since 2012, the author has used the above teaching process in the International Economics course with 2010 undergraduate students of International Economics and Trade at Beihua University. The following results were obtained from an analysis of the students' results in the International Economics course for 2011, 2012 and 2013.

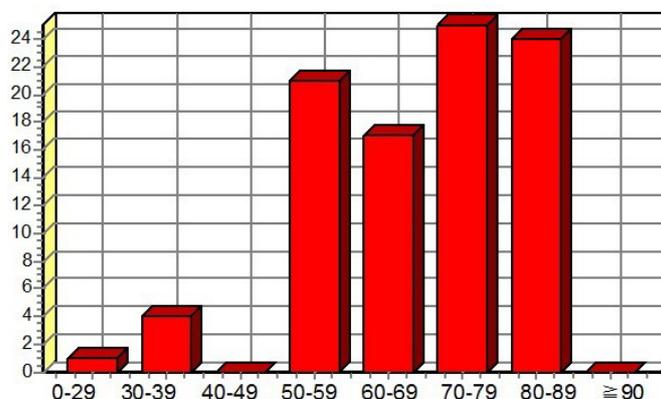


Figure 2: The 2011 final scores distribution for the International Economics course.

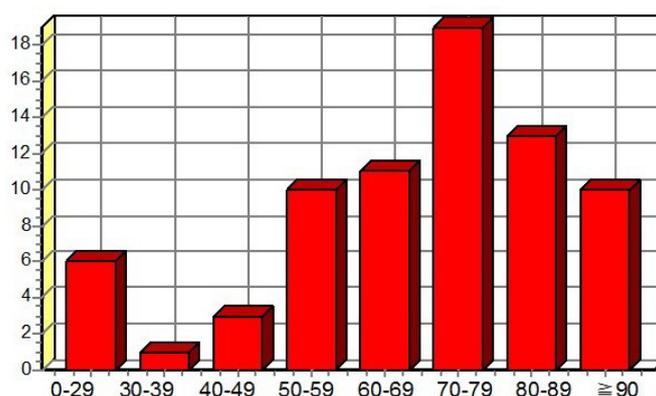


Figure 3: The 2012 final scores distribution for the International Economics course.

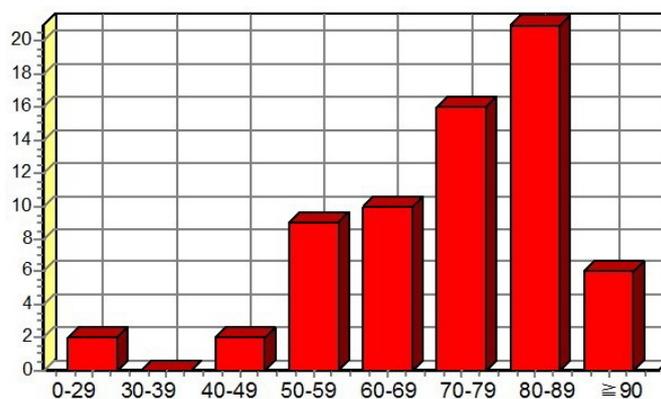


Figure 4: The 2013 final scores distribution for the International Economics course.

Table 2: Analysis of the 2011 final scores for the International Economics course.

Performance item	Analysis	Calculation	Memory	Understanding	Comprehension
Total score	20.00	30.00	15.00	20.00	15.00
Average	13.21	20.74	8.77	15.41	9.67
The percentage (%)	66.1	69.1	58.5	77.1	64.5

Table 3: Analysis of the 2012 final scores of the International Economics course.

Performance item	Analysis	Calculation	Memory	Understanding	Comprehension
Total score	20.00	30.00	15.00	20.00	15.00
Average	15.75	19.42	10.51	13.58	8.58
The percentage (%)	78.8	64.7	70.1	67.9	57.2

Table 4: Analysis of the 2013 final scores of the International Economics course.

Performance item	Analysis	Calculation	Memory	Understanding	Comprehension
Total score	20.00	30.00	15.00	20.00	15.00
Average	15.09	20.30	10.38	15.06	11.86
The percentage (%)	75.5	67.7	69.2	75.3	79.1

The figures and tables above show the final results between 2011 and 2013. Figure 2 shows that the 2011 results were fairly flat, with an inadequate differentiation of results. In 2013, most results are *good* to *moderate*. Table 2 to Table 4 describe the trend of changes in performance items. As is shown, increases have taken place in analysis and memory, from 2011 to 2013.

A significant fluctuation has taken place in comprehension, first a fall and then a rise, in the same period. In addition, calculation and understanding have remained stable over these years. Through improvements in teaching, the distribution of final scores is more regular and trending toward a normal distribution. Many students in the semester after the course were able to identify correctly the key points in the international economics course and to demonstrate an improved mastery of the course content.

CONCLUSIONS

It is essential that universities in China dedicated to staff training, and to education, reform their traditional teaching practices. The study presented here is of an investigation of the teaching process using a random sample of students. It was found that after the teaching process was modified, the students' grades showed obvious improvement. Most students' results were in the classifications of *good* and *moderate*. The teaching changes have resulted in better grades.

The students were in a position to gain a deep understanding of International Economics, and most of them had the ability to recall the knowledge and content of this course for some time after the end of the course. The random sample investigation method used in this study also has been applied by one of the authors to a resources survey on seeds of the deciduous tree, *Acer mono Maxim* in another study.

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