



Application of Example Analysis of Heuristic Teaching and Inquiry Teaching to College Mathematics Teaching

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In this paper, using concrete instances, we mainly discuss how to develop students' thinking via college teachers in the process of the practice of heuristic teaching and inquiry teaching of college mathematics.

1. Introduction

Students are the main parts in the entire teaching process, the key of university mathematics education reform is to arouse students' truly appreciating and really knowing the importance of mathematics, is to stimulate the potential of students to study hard from the heart, is to stimulate the passion and power of students to learn mathematics, and finally is to explore the law of mathematical knowledge. In this session, teachers should draw some flash and good examples to guide students to know and explore mathematical knowledge.

2. Ask questions

Einstein once said, "ask a question is often more important than to solve a problem. Mr Tao Xingzhi once said:" the innumerable invention, starting point is asking ". Thus, how important the ability is that training the student to discover problems and to ask questions. Asking questions are the prelude to the teaching process, is to introduce students to the beginning of the role. Teachers should according to the teaching contents and requirements of each lesson, teaching important and difficult, the foundation and ability of students to the reasonable design problem. Problem of can't is the teacher's questions, moaning whinge-bags mechanical, but to have its naturalness, enlightening, logic; Students can't always problem of passive, some issues that need to be the teacher regarding the teaching subject, creating an environment of the students through observation, analysis, abstract; There are some problems is found in the process of students in learning and discussion and put forward. In fact, the learning process is put forward problems, analyzing problems, the process to solve the problem.

Different teaching contents have different characteristics, different target tasks, this needs us make perfect design according to the specific circumstances. In the process of design and implementation of the following is need our attention, we call it the four basic principles:

(1) The thematic and progressive principles: first, we need to make clear the teaching task of each lesson with the target, the emphases and difficulties grasp, to make a global deployment and hierarchical arrangement. A class can't seemingly lively, the result is to pick up the sesame, lost watermelon, not up to the teaching goal. We ask questions both want to consider the logical relationship of knowledge contents and to consider the students' cognitive level. Problem is too shallow to reach the teaching effect, hard and can make the students at an impasse, lose confidence. To do this, the teacher needs to read textbooks, understand students, carefully designed.

(2) The principle of objectivity and universality: any put forward a concept has its objective background, any aformula, theorem of its general significance. People always know something concrete to the abstract, from individual to general. So we must be appropriate to introduce before asking questions its background, causes the student to enter the state. Ask questions from the concrete to the abstract, from the individual phenomenon to explore the general rule, it is of great help to the cultivation of students' innovative thinking.

(3) Revealing and exploratory principle: questions aim is not just in order to attract students, or to ask the way to achieve the goal of imparting knowledge. We also hope that through this form to guide students to find rules, to search methods, to reveal the truth. So we very enlightening, for students to explore space, play for their creativity. Inspire students to think, found that to master the methods of dealing with problems. If the

teaching materials directly given by the teacher, the definition of students got is some mechanical memory. We don't have to ask questions in advance, its purpose is to give students leave to explore space, let them study the general method of the problem. To seek to master the research methods, the idea is very clear.

(4) Subjectivity and strategic principle: the main body of classroom teaching is the student, to give full play to the initiative and creativity of students. The student is not a question of follower, teachers should create conditions to let students to discover problems, ask questions. Ask students to find and ask questions to the teacher's and we talked about earlier to "global deployment and hierarchical arrangement" is not a contradiction, the teacher is the commander of classroom teaching, can't dozen battle without preparation, careful planning is a must. Strategic flexible processing refers to teacher to the students' various problems, timely detection, improve the occasion, the organic integrated into the teaching process.

3. Explore the method to solve the problem

3.1 Example analysis

Cited Example: An intuitive thinking of Young's inequality:

If $a > 0$, $b > 0$,

and $p > 1$, $\frac{1}{p} + \frac{1}{q} = 1$

then $ab \leq \frac{1}{p}a^p + \frac{1}{q}b^q$

From $\frac{1}{p} + \frac{1}{q} = 1$,

we obtain $(p-1)(q-1) = 1$.

If $u = t^{p-1}$,

Then $t = u^{q-1}$.

For any two positive number a ,b. As is shown in Figure -1 and Figure -2:

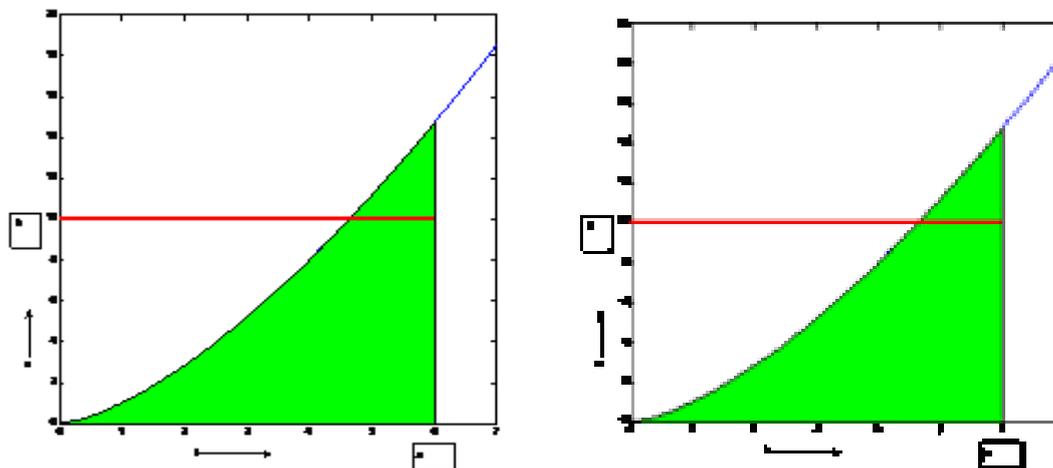


Figure 1: Schematic diagram of the young's inequality proof

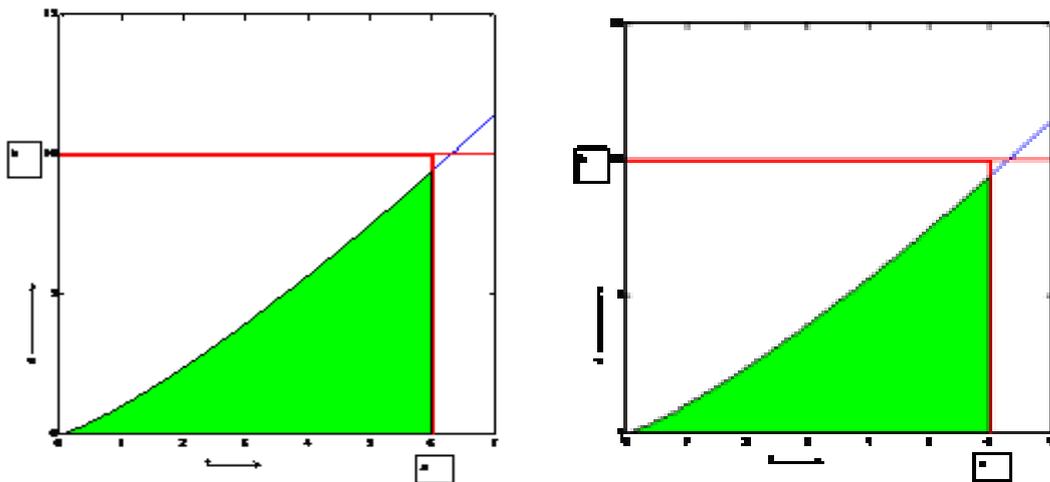


Figure 2: Schematic diagram of the young's inequality proof

It is easy to know the rectangular area ab does not exceed the sum of the shadows with blank area:

$$ab \leq \int_0^a t^{p-1} dt + \int_0^b u^{q-1} du = \frac{a^p}{p} + \frac{b^q}{q}$$

3.2 Inspired by examples, to help students master the learning initiative and to explore the meaning of mathematical concepts

As is well known that if Infinite series $\sum_{n=1}^{\infty} u_n$ convergence, then $\lim_{n \rightarrow \infty} u_n = 0$. However, if the infinite integral

$\int_a^{+\infty} f(x)dx$ converges $\Rightarrow \lim_{x \rightarrow +\infty} f(x) = 0$ (Not satisfied). In the teaching, we can first let the students consider the following proposition:

Proposition 1: If $\int_a^{+\infty} f(x)dx$ convergence, and $\lim_{x \rightarrow +\infty} f(x)$ is significant, then $\lim_{x \rightarrow +\infty} f(x) = 0$.

Proposition 2: If $\int_a^{+\infty} f(x)dx$ convergence, and $f(x)$ is uniformly continuous in $[a, +\infty)$, then $\lim_{x \rightarrow +\infty} f(x) = 0$.

Proposition 3: If $\int_a^{+\infty} f(x)dx$ convergence, and $f \in C[a, +\infty)$, Then there is the sequence $\{x_n\} \subset [a, +\infty)$ such that $\lim_{n \rightarrow \infty} x_n = +\infty$ and $\lim_{n \rightarrow \infty} f(x_n) = 0$.

Combined with examples: Discriminate convergence or divergence of generalized integral $\int_0^{+\infty} \frac{x^q dx}{a + x^p \sin^2 x}$ ($a > 0, p, q > 0$).

In the teaching process: take $q = a = 1, p = 6$ make the graphics of integrand $f(x) = \frac{x^q}{a + x^p \sin^2 x}$,

As is shown in Figure -3:

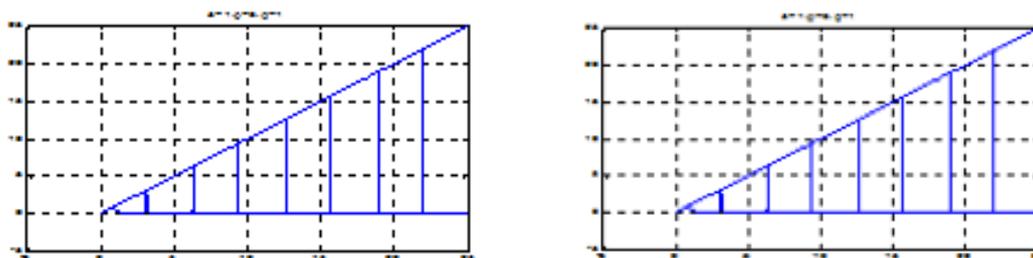


Figure 3: Discrimination diagram of generalized integral divergence by integrand

Intuitively students can find from the graph: The possibility of convergence of generalized integral. Teachers can guide them to give strict proof (Proof see [1]).

In the teaching, the students can raise the following questions:

(1) $\int_a^{+\infty} f(x)dx$ convergence, $\lim_{x \rightarrow +\infty} f(x)$ may not exist, and $\overline{\lim}_{x \rightarrow +\infty} f(x) = +\infty$.

(2) In the above example, what role and requirements the parameters a, p, q have, Combine graphics and proof ideas, actually: As long as the product function $a \neq 0$, $\frac{p}{2} > q + 1$, It can get the convergence of the generalized integral. In the first quadrant when $x = k\pi$, there are numerous intersections between $f(x)$ and $y = x^q$ ($k\pi, (k\pi)^q$). When $x \neq k\pi$, if $a \neq 0$, the function value $f(x)$ declines sharply and tends to x-axis.

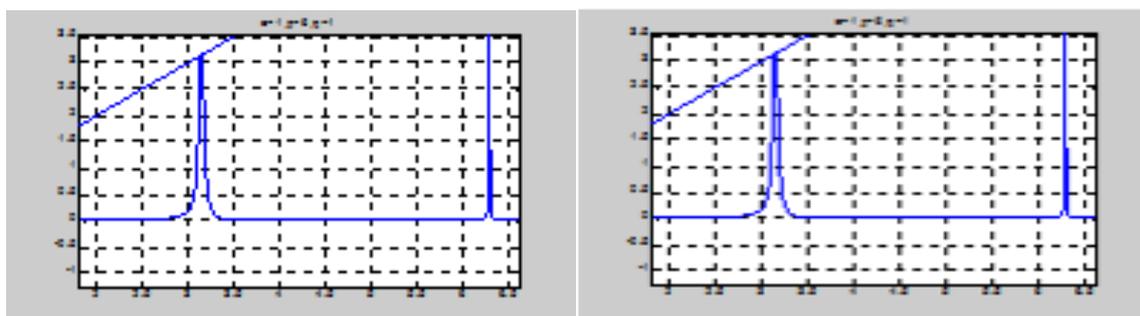


Figure 4: Diagram about discriminant function convergence by curve change

(3) Rethinking binding proposition in this case, students will have a clear concept.

3.3 Make full use of tools to stimulate the enthusiasm of students to explore the graphic geometric surfaces law

In a teaching of conicoid of space analytic geometry, we usually enable students to understand and grasp the surface pattern by analyzing and discussing the characteristics of the equation itself, For example, for the equation of hyperboloid $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$, with the discussion of its apex, main section and parallel stub, we

only know a general idea of shape of the surface. In this process, because the graphics only is pictured statically in the demo board, even if teachers explain in great detail, the students still can not grasp more deeply shape and structure of curved surface, however, with the use of MATLAB tool, dynamically demonstrate single-leaf hyperboloid of formation, we can stimulate students' spatial imagination, guide students to develop an understanding of the shape of the surface, and then make students grasp more deeply and accurately the characteristics and formation process of hyperboloid so that simple teaching process becomes more vivid and intuitive. As is shown in Figure -5:

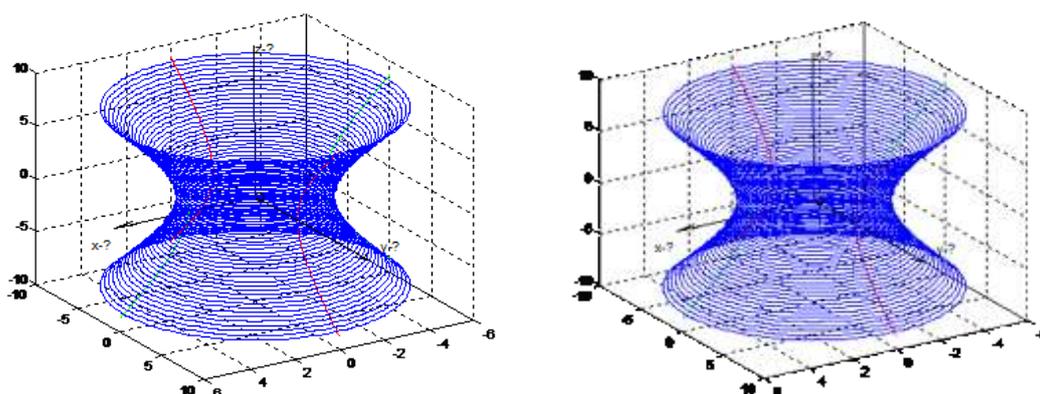


Figure 5. Dynamic demonstration schematic hyperboloid of one sheet

3.4 Methods to investigate

(1) Student is the main body of teaching, and is also an effective facilitator for classroom teaching. The reform of teaching mode and teaching method, First of all, to change "to teach the teacher as the center" of the traditional teaching idea, to give full play to the initiative and creativity of students.

If our teaching mode is to improve students learning enthusiasm and initiative, So our teaching goal is to make students master the knowledge better, learn a rational mode of thinking, and method of induction, analysis and interpretation, To build up their ability of analyzing and solving problems, Especially the innovation consciousness and innovation ability. Guide students to discover problems, to explore the method to solve the problem are an effective way to achieve these goals.

(2) Teachers must be good at inspire students' thinking, excavate the potential of students and find the best thinking of students, encourage students' creativeness.

When a class broke the traditional teacher at them, when the student thought the sparking spots in effective encouragement, the spark of students' thinking will be lit, enthusiasm, the activity will be greatly improved, this is our teaching. But often also has the following two conditions: one is due to individual differences, there are some students seldom express their views, or always in a passive state; 2 it is because of the problem set reasonable enough, or problem itself has considerable difficulty, thus appeared the phenomenon of teaching to promote the "stagnation", which requires the teacher suit the remedy to the case, the reasonable inspired, or even specific guidance to help. Only opened, and the students' thinking and get a sense of achievement, they will have more confidence,

(3) To strengthen the teaching of mathematics experiment auxiliary function

Introduced in basic course teaching of mathematics experiment, through the exploration, discovery, understanding of the theory and mathematical content, inspire the students' learning interest and enthusiasm on curriculum, to make the students have mastered the mathematical knowledge more solid, more profound experience. At the same time in the school of the experiment, observation, found that students cultivate their spirit of exploration, so as to pay more attention to the study of theoretical knowledge. Thus, the introduction of mathematical experiment can strengthen the students to the theory of knowledge learning. Therefore, teachers should strengthen the auxiliary teaching of mathematics experiment study, to make the students from the boring mathematics gradually transition to love mathematics, armed with modern mathematics thought the mind, improve their ability to analyze and solve problems.

A few years of teaching practice has proved, Inquiry teaching is an effective teaching mode, It has changed the traditional teaching of teachers' teaching, students are imitating the passive learning style of practice. This not only stimulated the students' innovation enthusiasm, and inspire students' thinking and improve the students' learning initiative and enthusiasm, improve their ability of research, criticism and creation ability has played a good role. At the same time, students in the process of mutual exchange and the discussion also learned to respect other people, to enhance the sense of team spirit and cooperation.

4. Conclusions

In short, with intuitive graphical presentation, guided by teachers to inspire students to explore and summed up the law, so make abstract mathematical concepts become intuitive, vivid, and easy to understand, thus stimulate students to create enthusiasm, and further tap the potential of students to learn, develop and improve the research ability of students to explore mathematical knowledge. In addition, through careful preparation and concise expression, it is possible to stimulate interest of people with original indifference in mathematics, so as to further arouse research interest of people to explore the laws of mathematics. This point is the maximum advantage of heuristic teaching and inquiry teaching.

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