



Construction of teaching case base of “Special Topics on Information Technology in Education” based on geometric sketchpad

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Abstract. Based on years of teaching experience in geometry sketchpad, we analyzed the present situation of the case teaching of the geometric sketchpad, discusses the design principle and content frame of the teaching case of “Special topics on educational information technology” based on the geometric sketchpad.

Keywords: The Geometer's Sketchpad; Case teaching; Case base;construction

1 Introduction

On May 7, 2015, the Ministry of Education issued the “Opinions on Strengthening the Construction of Case Teaching and Joint Training Bases for Professional Degree PostGraduates”, it is clearly pointed out that case teaching should be strengthened in the process of graduate training^[1]. The Case method was founded in 1870 by Christoph, Prince of Schleswig-holstein Randall^[2], Dean of the Harvard Law School, later adopted by Harvard Business School, at present, it has become a mature and widely used teaching method, it provides highly realistic problem scenarios through case studies, let students try to make independent judgments and decisions in the analysis of specific problems, in order to train students to use the theory to solve practical problems of a teaching method. Case teaching is an important means to stimulate students' interest in learning and consolidate their learning effect. The establishment of case base is beneficial to link up the theoretical teaching with the practical teaching, is conducive to enhancing the comprehensive ability of students, is conducive to communication and exchange between teachers. It realizes the sharing of teaching resources, it can also be used as a useful supplement to other teaching methods such as leading and discussing.

Through research, we found that, in recent years, teachers pay more and more attention to the application of case teaching in teaching. Miu Hongchao take “intelligent textile” course teaching case base as an example, discusses the means and objectives of the construction of graduate course case base^[3], Zhou Zhaoyan explores the construction of ideological and political case base of “college physics” course^[4], based

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on higher engineering education background, Liu Fang

Construction of case base for the course of “Water treatment engineering”, and give the implementation plan [5]. The construction of teaching case bank has achieved initial success, but accumulation is still relatively scarce, the case base of the post-graduate course system combining theory and practice is still weak, build a high-quality case base that meets the requirements of graduate training objectives, it is worth studying deeply to improve students' practical ability.

“National medium and Long-term education reform and development plan outline” pointed out: strengthen the application of information technology, Improve the level of teachers' application of information technology, Renew the teaching concept, Improve teaching methods, Improve the effectiveness of teaching. The Ministry of education promulgated “Mathematics Curriculum Standards (2022 edition)” pointed out: “Teachers can use information technology to process text, images, sounds, animations, etc, design lively teaching activities, enrich the teaching scene, promote the reform of mathematics teaching methods. The mathematics experiment is carried out by using the mathematics special software and other teaching tools, to visualize the abstract mathematical knowledge, stimulate students' interest in learning mathematics and desire to explore new knowledge, to promote students' understanding of mathematical concepts and construction of mathematical knowledge [6-11]. In practical problem solving, create a reasonable information-based learning environment, to enhance students' enthusiasm for inquiry, broaden the students' horizons, stimulate the imagination of the students, improve Students' information literacy”.

The geometric sketchpad is to meet the needs of the information society, in view of the modern educational technology software developed by the reform of educational means, educational methods and educational forms, the software is mainly guided by the theory of “Constructivism”, give students an open space of thinking, a process of construction, to combine computer technology with mathematical ideas organically, to realize the combination of computer visualization, animation, link technology, fast graphic processing function and mathematical continuous thought, transformation thought and limit thought, to realize mathematics from static to dynamic, from abstract to image, from micro to macro, from qualitative to quantitative teaching, to make the transformation of form numbers more natural, so that students can grasp the problem with the concept of connection and wholeness, in order to train students to keep enterprising, active exploration, innovation and the ability of comprehensive application.

In order to improve students' practical and applied abilities, in recent years, more and more attention has been paid to the application of Case method in teaching.

2 Content of construction

“Special Topics on Information Technology in Education” is a non-degree course set up by our school for master of education in mathematics, it mainly about the operation and application of geometric Sketchpad software, the Geometer's Sketchpad software includes: draw with the toolbox tool, draw with the construct menu, use the

transform menu for drawing, operation Class button making, file edit menu, measurement menu, data menu, drawing menu and other chapters of the teaching content. This project intends to build 8-10 high-quality teaching cases, to enable students to master the basic operation of the geometric Sketchpad and the comprehensive use of the tool's ability. Students can work in groups, discuss the case in depth, form an analysis report or paper, and to present the results in the form of pleadings, in order to achieve the integration of teaching content and flexible use. The application of case base in this course, will help students to master the use of geometric sketchpad to solve mathematical problems, and for the students in the future mathematics teaching information, visualization, dynamic to provide help. The construction content mainly puts the geometry sketchpad in each chapter for the operation of various tools, and apply it to mathematics teaching in primary and middle schools. For example:

2.1 Case 1(Application of geometric Sketchpad in mathematics teaching in primary schools): Discover the beauty of mathematics, develop students' positive feelings of mathematics

“Mathematics curriculum standards” Points out, apart from developing students' intellectual development, teachers must pay attention to the development of students' moral and aesthetic education, make efforts to train students into all-round development. In the classroom teaching of mathematics in primary schools, teachers make courseware by using geometric sketchpad, not only can help students deepen their understanding of knowledge, also can strengthen the student to mathematics beautiful edification, improve students' ability to discover and create beauty. For example, the fourth grade symmetry of this class hours, teachers can use the geometry palette to move the picture completely, the most typical is the butterfly fold in half, by clicking the fly button, the wings of the butterfly will continue to overlap and expand, such a design can not only enhance the fun of the classroom, let the students understand the definition of symmetry in surprise and joy. Can also make more symmetrical graphics, such as the flying leaves, the beauty of overlapping Chinese characters and so on.

Through the study of this case, students will be able to master the functions of reflection, animation, hidden display buttons, etc, and can understand the geometric sketchpad in the teaching of the help, inspire students to innovate teaching design, show the beauty of mathematics.

2.2 Case 2(Application of geometric Sketchpad in mathematics teaching in primary schools): The significance of fractions

In the teaching of “The meaning of fractions”, the units of fractions are difficult, the significance of the score is the point. To help students understand the units of fractions and their meaning, traditional teaching usually adopts model or object demonstration, but it is difficult to highlight the key points and break through the difficulties. The use of geometric Sketchpad production design teaching, breakthrough difficulties, improve students' interest in learning. First of all dynamic flicker 1 round pizza,

make “Unit 1” the concept of life and visualization; presents an animation of “Split into 10 equal parts”, image portrayal denominator; flashing “One of them”, the image portrays the molecule. The cognitive process of denominator, numerator and fraction unit is highlighted through the combination of numbers and figures and dynamic visual images. Then control the parameters, the graph corresponding to any numerator and denominator is displayed dynamically. This visual “From special to general” thought process, abstract into an image, it reduces the load of students' cognition of “The units and meanings of fractions”, promote students' understanding and increase learning fun and confidence.

Through the study of this case, students will master the geometric sketchpad animation, data, calculation, operation of buttons, color parameters and other functions of the operation and application. It also allows students to discuss, design a teaching process by yourself, cultivate students' ability of teaching and research, experience the help of geometry sketchpad in teaching.

2.3 Case 3(Application of geometric Sketchpad in mathematics teaching in primary schools): Dynamic presentation of the true score

“Know a few parts” is the People's education version of the third-grade math volume content. “Knowing the fraction” as the “Root” of grade learning in primary school, the necessity of the experience score and the meaning of a fraction, for the next few parts of the meaning of learning, fractions of the four operations to provide a foreshadowing. A few of the meaning of this lesson is the focus and difficulty of teaching, how to stress the key points and solve the difficult points is a thorny problem in traditional teaching. Applying the iterative function of the geometric sketchpad, divide the circle into equal parts, and paint one of them a beautiful color, dynamic demonstration by clicking the button, let students know the true fractions of different denominators, highlight the key points and crack the difficult points, improve the effectiveness of teaching.

Through the study of this case, the students will master the functions of iteration, depth iteration, animation, calculation, parameter and so on. Students can imagine the design of the teaching process, make the graphic design more beautiful, increase the beauty of mathematics, enliven the classroom atmosphere.

2.4 Case 4(Application of geometric Sketchpad in mathematics teaching in primary schools): Knowledge of horns

We need to know “Horn” in primary school mathematics. Depending on its degree size, we can divide it into zero angle, acute angle, right angle, obtuse angle, flat angle, etc. The degree of the right angle is 90° , anything less than that is called an acute angle, anything larger is called an obtuse angle. Design teaching with geometric sketchpad, increase students' interest in learning. Using the operation button function to make “Zero angle”, “Acute angle”, “Right angle”, “Obtuse angle” and “Flat angle” such several buttons, draw angles with line ruler, one side of the corner is fixed, the other side can be rotated to various angles. When we click on the button for the dif-

ferent types of corners, one side of the angle will be rotated to the right angle for that angle, form an angle of the corresponding type. Through such a demonstration process, the students can feel the differences and connections between these angles intuitively, this enables a more thorough understanding of some of the basics of this part of the angle.

Through the study of this case, students will master the geometry of the drawing board toolbar, move, Mark, measure, the operation of buttons and other functions of the operation and application.

2.5 Case5(The application of geometric Sketchpad in junior mathematics teaching): The similarity of graphics

This case is the teaching content of chapter 27 in the second volume of grade 9 of the People's education press. According to the new curriculum requirements, the overall teaching objectives of this section are: in the process of exploring, discovering, confirming and proving the nature of graphics, establish the concept of space, develop geometric intuition, develop reasoning ability. Design teaching with geometric sketchpad, can be very convenient to zoom in and out of graphics, not only visual, but also can help to explore the similar and bit-like nature. Using the iterative function of the geometer's sketchpad, can Show students many wonderful fractal patterns with self-similarity, such as the Sierpinski carpet, the beautiful Kohler Snowflake Curve, let the student understand the fractal geometry this mathematics branch, stimulates the student to mathematics the strong interest.

Through the study of this case, the students will master the operation and application of the functions of translation transformation, multi-mapping depth iteration, movement, etc. Once again, let the students feel the powerful function of the geometric sketchpad, increase the interest in learning the software and curiosity.

2.6 Case6(The application of geometric Sketchpad in junior mathematics teaching):Graph and properties of quadratic function $y=a (x-h)^2+k$.

This case is the teaching content of chapter 22 in the first volume of grade 9 of the People's education press. The new course standard points out, the quadratic function teaching must let the student from the quadratic function dynamic characteristic observation process, make assumptions, and through the experimental way to explore the internal relationship between knowledge points and the corresponding conclusions of the derivation process. Using the geometric sketchpad to create a good mathematical environment, explore the image and properties of quadratic function. The dynamic process of drawing the image of quadratic function $y=a (x-h)^2+k$ with the method of tracing points is realized by the geometric sketchpad, set a , h , and k as parameters, using the effect of hot text, an analytic expression of dynamic function with parameter change is established, observe and analyze the quadratic function $y=a (x-h)^2+k$ image and properties by changing their values, the opening direction, symmetry axis, increment and decrement, vertex coordinates are summarized.

Through the study of this case, students will learn how to use a geometric sketchpad to create an analytic function with parameters, learn how to use hot text, draw a table by calculation, through the custom transformation on the computer to achieve the point, line animation effect, let the students feel the powerful function of the geometric sketchpad, Increase the interest in learning the software and curiosity.

2.7 Case 7(Application of geometric Sketchpad in high school mathematics teaching): Graphs and properties of exponential functions

This case is the teaching content of Section 4.2.2 in the fourth chapter (exponential function) of the first volume of high school mathematics, function image is an important carrier to study the properties of function and understand its concept. Use the powerful drawing function of the geometer's sketchpad to draw an image of the function $y=a^x$ ($a>0$ and $a\neq 1$). Start by drawing an image of $y=a^x$: a list of data menus with the help of a geometry palette, with the help of the drawing menu to establish the coordinate system, trace points, and then through the custom transformation and special characters to achieve a dynamic hand-held pen line effect. By changing the value of the base number a , an image showing other exponential functions on the fly. Take advantage of the tracking curve function, the changing characteristics of exponential function images with different bases are recorded, this helps us to observe the change of the function as a whole, and look at the details, to get a lot of information about the characteristics of the function, this will greatly facilitate us to generalize and generalize the properties of functions and to discover the differences and connections between different functions.

Through the study of this case, students will master the Geometry Sketchpad of the data menu list, draws a function image, custom transformation, tracking and other functions of the operation and use. Students can design their own teaching programs, similarly, students can use the geometer's Sketchpad to design the graphics and properties of other functions such as trigonometric functions ($\sin x$, $\cos x$, $\tan x$), train students to analyze and solve problems.

2.8 Case 8(Application of geometric Sketchpad in high school mathematics teaching): The formation of a cylinder, cone, pedestal, and ball

This case is the teaching content of 8.1 section of the eighth chapter (preliminary solid geometry) of senior high school mathematics. With the help of geometric sketchpad to provide rotating drawing and track the function, the forming process of a cylinder, cone, pedestal, and ball, it is helpful for students to grasp the structural features of these rotations. The geometric drawing board is accurate, the students can repeat the demonstration many times, it is of great help to cultivate students' spatial imagination.

Through the study of this case, the students will master the operation and application of geometric Sketchpad's rotation command, tracing command, erasing command and custom tools. Students can design their own teaching programs, exercise students' ability to analyze and solve problems.

3 Conclusion

According to “Educational information technology” object for the characteristics of the Master of Education, in the course of teaching, we pay attention to the combination of case and mathematics teaching practice and geometry sketchpad software when we choose and design the content of teaching cases. The construction of case base suitable for teaching is a process of continuous enrichment and perfection, believe with the mining and addition of typical cases, Case Base will become a very valuable teaching resources. Integrating geometric Sketchpad software and Case method into the teaching of educational information technology projects, is a new trend of teaching reform, it will improve the teaching effect of the educational information technology project, to promote the study enthusiasm of Master of Education and the promotion of the level of educational scientific research, at the same time enrich the teaching system.

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