

Research on the Classroom Teaching of 3D Design Software Based on Dual-Core Linkage

Xiaowei Qian*, Rujia Jiang

Wenzhou Polytechnic, Wenzhou, Zhejiang, 325000, China
Email: 762612666@qq.com

Abstract. Based on the problems of inadequate targeted learning materials, incomplete explanation of core commands, poor transformation of practical training projects, and the rejection of art students' learning of 3D software courses, we build a classroom teaching model of 3D design software based on dual-core linkage. For the core of knowledge deconstructive acquisition that stimulates students to learn effectively, we develop media-rich teaching resources; for the core of externally-driven creative application of skills, we establish a library of real projects of multiple types of enterprises to effectively enhance teaching effectiveness and improve teaching quality.

Keywords: 3D design software, teaching resources, real project library

1 Introduction

With the in-depth development of industrial design in China, product design, as an important part of industrial design, has received continuous attention and promotion. For product design, the field of employment has been greatly expanded, in which design companies and enterprises are paying more and more attention to the designer's ability to perform the program. In the program performance capability, three-dimensional modeling is the core design steps in the field of product design, especially product model visualization, product model modification and improvement, product rendering design, product final program display in a very critical position in the design process [1] [2].

At present, most of the students in higher vocational schools have a poor learning foundation and generally lack clear motivation and good study habits. In particular, the majority of students majoring in product design are art students. These students often have weak spatial thinking ability, easily frustrated learning process, and blind and passive learning goals. The learning of three-dimensional software is often more complex and obscure for them, and traditional classroom teaching is mostly coarse but not precise, fine but not thorough, leading to students in the learning process, once frustrated, they are in a discouraged state [3] [4]. Therefore, how to build students' 3D software skills in the training of product design talents is an issue worthy of in-depth consideration in the transformation and development of industrial design majors at this stage.

2 Poor Status of "Teaching" and "Learning" in 3D Modelling Courses

2.1 Insufficient Relevance of Learning Materials

The Rhino learning books on the market today are generally aimed at a variety of art and design disciplines, including product design, transportation design, jewelry design, character animation, and other disciplines. This leads to a series of books to include the knowledge of three-dimensional modeling, but also to supplement the model rendering, animation settings and other knowledge content. This inevitably leads to the classification of product modeling is not comprehensive enough, the actual case of the demonstration is not typical.

2.2 The Core Commands Are Not Well Explained

There are a lot of professional books and online video resources for Rhino 3D software. Most of the professional books are thick but not practical, and they often spend too much energy to introduce all the

basic commands one by one. There is a lack of analysis based on the frequency of use of different basic commands. Most of the core commands in Rhino are just demonstrations, not in-depth analysis of the principles behind the creation of the shape, the reasons for using the commands, or how to differentiate between similar commands. It's hard to inspire students to learn from the others.

2.3 The Practical Training Program Is Not Very Transformative

In the process of learning Rhino 3D software, because of its step-by-step and forgettable nature, art students have a high forgetting rate and a low conversion rate in the later training projects. However, the existing learning courses are not systematic enough, and there is a lack of continuous hands-on projects for different learning objectives at different stages. Once students forget the modeling method, their desire to repeat the learning process is greatly reduced, which makes it difficult to motivate students to maintain their enthusiasm and persistence in learning Rhino 3D software.

2.4 There Is a Reluctance on the Part of Art Students to Study Smart Technology Courses

The majority of art students are weak in spatial thinking, and they are prone to have difficulty digesting commands and failing in physical modeling, and are easily frustrated in self-confidence, irritability, negativity, and even giving up in the process of learning intelligent technology software, especially 3D software. In addition, most of these students have a poor learning foundation, and generally lack the motivation and habit of diligent and persistent learning. In the process of being taught, they tend to forget about modeling methods and neglect to practice.

However, due to their own long-established learning characteristics, they are often easily frustrated in the learning process of intelligent technology courses, especially 3D software, which greatly reduces their patience and enthusiasm for such courses.

3 Build a Curriculum Reform Model Based on Dual-Core Co-Creation

3.1 Learning Dynamics Internal Core - Knowledge Deconstructive Motivational Core

The internal and external cores are used to stimulate the learning motivation of Rhino 3D software. The internal core is the target motivation core, which sets the basic modeling target, middle level modeling target and high level modeling target according to the different learning progress in the learning process. When learning the basic command, complete the creation of simple basic model. When learning the core commands, complete the mid-level modeling goals that require multi-surface mixing and polymorph formation. After mastering all the commands, through the high-level objectives of complex tool products, you will reflect on the common principles of basic commands and core commands, compare the differences in modeling efficiency between various modeling ideas, and conclude the most efficient and high-speed modeling method for different shapes. Through the three levels of low, medium and high level objectives, you can achieve a sense of accomplishment by learning small objectives and consolidate the comprehensive use of Rhino software.

3.2 The External Core of Learning Motivation - the Core of Creative Use of Skills

The external core of the learning motivation is the field-driven core, and the course introduces multiple types of real-world projects in companies with long-term markets. Different types of corporate modeling projects are introduced according to the different modeling abilities of students. Students with weaker modeling skills are given priority to undertake small enterprise modeling projects independently, such as faucet design, bathroom basin design and other single product design problems. Through repeated modeling, refinement and perfection of small products, they can consolidate their basic modeling skills. Students with excellent modeling skills mainly participate in large enterprise modeling projects undertaken by the team, such as: children's playground design, children's park design and other large integrated design projects. Through the overall environment of the modeling task allocation, collaboration, competition, enhance their own multiple product modeling efficiency, and create a close teamwork spirit. The real

corporate projects introduced in the course are time-sensitive, sustainable and long-term, which helps students to significantly improve their ability to learn software and transfer it to hands-on project design through a lasting design experience.

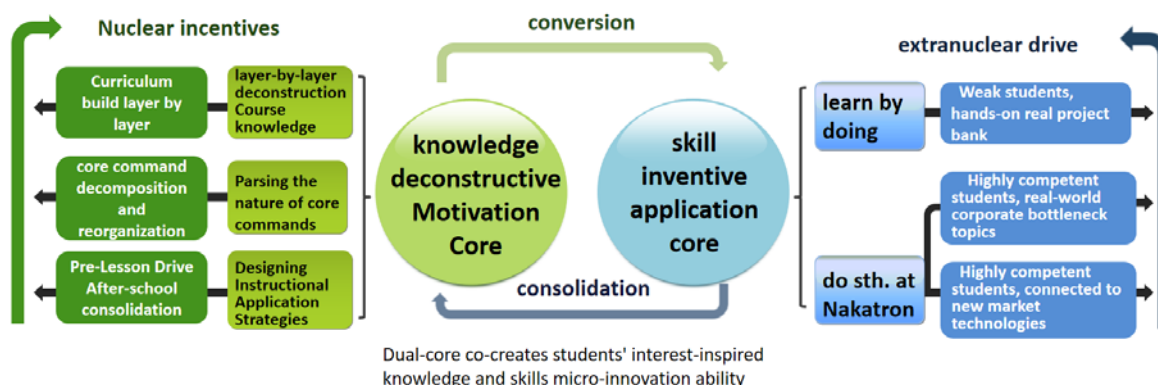


Figure 1. Construction of the dual core linked teaching model

Table 1. Deconstructing the curriculum of 3D design software

	Module	Assembly	
Deconstructive acquisition of knowledge	Module 1.	Component 1: Introduction to Rhino	
	Rhino Basics	Component 2: Curve Application	
	Module 2.	Rhino Modeling Core Single Skill (Point of study)	Component 1: Built-up surface from side
			Component 2: Rotational forming
			Component 3: Monorail sweep
			Component 4: Two-track sweep
			Component 5: Proofing
			Component 6: Inserts
			Component 7: Mixing
Component 8: Articulation			
Component 9: Mesh surfaces			
Creative application of skills	Module 3.	Component 1: Making MP3s	
	Rhino Solid Product Modeling (line running through)	Component 2: Juicer modeling	
	Integrated Practice Project		Component 3: Toothpick Holder Modeling
			Component 4: Bottle Opener Modeling
			Component 1: Shanghai Yunshape Design Co.
			Component 2: Wenzhou Xialang Sanitary Ware Co.
			Component 3: Shanghai Heyou Stationery Co.
Component 4: Yucai Holdings Group Limited: Small Toy Projects			
Matching enterprise new technology projects	Component1: Enterprise VR Product Modeling Project		
Enterprise micro-innovation project	Component2: Teamwork Large-scale enterprise modeling project		

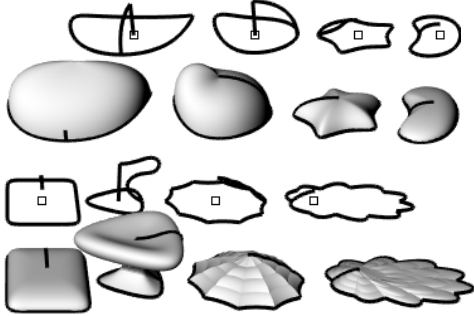

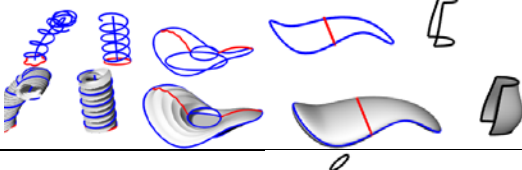
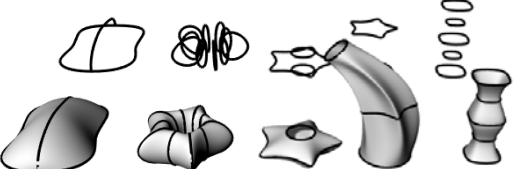
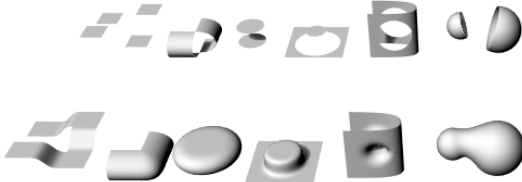
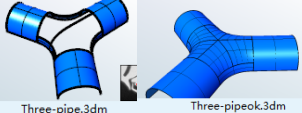

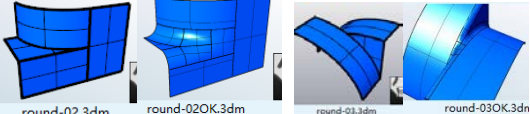
4 "3D Desing Software" Course Application

4.1 Sort Out Course Knowledge and Deconstruct It Layer by Layer in a Module-Block Logic

First, the course solution constitutes several resource modules formed by the structured combination of multiple knowledge and skill points, with the modules taking items such as work tasks as units of learning; then, each module solution constitutes several resource building blocks formed by the structured

combination of multiple intrinsically related materials, with the building blocks taking knowledge and skill points as units; and finally, each building block consists of materials, with the materials being the most basic, fragmented resources.

Table 2. Module 2 software core basic command profile

Core basic commands	Command Characterization	Development of a basic discovery model
Rotation	Find the central axis based on a line, and rotate the line into a surface.	
monorail sweeping	Faced by a track	
double-track sweeping	You need at least 3 curves to create, two as tracks to define the sides of the surface and one to define the cross-section of the surface.	
put on samples	Generating surfaces through transitions between curves	
hybridization	Create transitional surfaces between two surfaces, while including some continuity	
convergence	Adjusts edges so that they are positioned, tangent, or curvature-continuous with other surfaces.	
grids	Two curves (U, V) of different directions are used to generate the surface	
chamfer	Chamfer sharp edges into surfaces of various radii.	

4.2 Develop Media-Rich Teaching Resources That Address the Deconstructive Acquisition of Knowledge That Is Central to Stimulating Effective Learning for Students

4.2.1 Developing a curriculum base to explore rich media resources

The single skill module of each course is selected to grasp the core commands, analyze their characteristics, and develop a series of rich media teaching resources to grasp the essence of the commands and achieve skilled application. According to the cognitive ability of students, the core commands of Rhino modeling such as rotate, sweep, and release in Module 2 are selected, and their characteristics are analyzed to develop a series of exploratory models from easy to difficult, simple to complex. On this basis, according to students' learning habits and easy to forget, the operation points and corresponding shortcut keys are summarized into diagrams, the operation process is made into micro lessons, and the teaching difficulties are made into animations. This enables students to learn the corresponding knowledge points before the class, and also allows students with weak foundation to review them after the class.

4.2.2 Development of curriculum interest products rich media teaching resources

Based on the principle of comprehensive application of core commands, we select famous and interesting products and develop a series of media-rich teaching resources to arouse students' interest and eliminate their refusal to learn, so as to realize the comprehensive application of core basic commands. The product development ideas will be formed into analysis documents or videos, and the operation process will be made into micro-classes, and similar cases will be formed into after-class case banks, so that students can not only straighten out their project ideas through analysis documents or micro-classes before class, but also let students with weak foundations review them after class, and students with strong foundations strengthen their application ability by completing the after-class case banks.

For students' cognitive abilities, focus on the selection of well-known Alianse products, analysis of its modeling ideas, the formation of development ideas analysis document; the need to use the rhino core commands for analysis, the project is divided by operating procedures, the development of a series of operation video.



Figure 2. 3D modeling for fun product development

4.3 Build a Library of Real Projects for Multiple Types of Enterprises for Externally Driven Core Creative Use of Skills

According to students' different levels and advantages of software application, different types of enterprise real projects are selected for guided practice. These projects are designed for students with weak software application skills, such as those who are not strong in spatial thinking, weak in modeling, lacking in creative thinking, able to understand basic commands but lacking in independent creative design ability. They will focus on practicing existing small business project repositories and learn by doing in basic modeling tasks. Students with strong modeling skills, good spatial thinking ability, excellent modeling ability, and strong innovative thinking ability not only master the basic commands and core commands of the software, but also have certain design innovation ability. The students can not only master the basic and core commands of the software, but also have a certain degree of design innovation ability, and introduce many types of comprehensive design projects with long-term market and real-time updates.

4.4 Implementation of the Task-Driven "Explore, Analyze, Practice and Expand" Teaching Methods

We propose a holistic strategy of using rich media-based teaching resources in and out of the classroom, expanding from classroom-driven to pre and post-classroom-driven, with resources guiding students to interact effectively with the core skills they need to master before and after class. In the specific project teaching process, each project is broken down into three parts: exploring, implementing, and expanding. Project Exploration: according to the pre-class exploration teaching resource package, interpret the core commands, related project mastery and modeling difficulties for pre-class learning. Project implementation: follow the product completion process, arrange project implementation activities, and apply the knowledge students explored before class. Project development: complete the tasks in the project library after class to enhance students' ability to transfer knowledge from one to another.

According to the above project-based teaching design ideas, "3D Design Software" course is based on the task-driven "explore, analyze, practice and expand" teaching method. 1) Explore (before class): Take the educational games, project analysis micro-video, basic exploration model, practical project task book and other resources as the carrier, the next lesson will be the main learning task throughout. Among them, distribute the task and ask students to explore on their own before class; 2) Analysis (classroom): at the beginning of the lecture, let students analyze the task before class, and guide them to summarize the essence of the command to run, and master the operation of the core command, for the real thorough analysis of how to correctly use this command in different shapes, models, different parts of the model or in a variety of different shape products drawing; 3) Practice (classroom): let them Students complete the project tasks, so that the course knowledge in the "teaching-practice-teaching" cycle of spiraling; 4) Extension (after school): provide students with classroom commands corresponding to the after-school extension project to stop related materials, and for the differences in students, assign different degrees of difficulty of the task, to increase student The ability to transfer knowledge "in reverse".

5 Conclusion

This paper confronts the pain points of art students in learning 3D design software, and builds a dual-core co-creation classroom teaching reform model based on ability iteration, the introduction of enterprise bottleneck issues and new technology application projects as the core of external skills creative application, the students' inner sense of achievement in achieving progressive sub-targets as the core of knowledge deconstruction acquisition, and the project results and market mechanism as the assessment criteria. The application of the model in the Rhino course effectively solves the problem that most students can only operate the task according to the teacher's demonstration steps and cannot "do one thing and invert another"; it also solves the problem that senior vocational students are generally not highly motivated to learn and have difficulty in maintaining their interest in learning; it also solves the problem that students have poor ability to apply knowledge comprehensively and their level of competence varies and their ability is not uniform. The problem of discrepancies exists; it addresses the lack of thorough explanation of core commands, the lack of translatability of hands-on projects, and the lack of relevance of learning materials in senior-level 3D modeling courses.

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