

# Application of Network Resources in Teaching of Engineering Drawing Foundation

Xuwei Bai<sup>1</sup>, Dezhi Ren<sup>1</sup>, Xaing Yue<sup>1</sup>, Wenwu Wang<sup>2</sup>, Juan Liu<sup>2\*</sup>

1College of Engineering, Shenyang Agricultural University, Shenyang 110866, China.

2School of Civil Engineering, Liaoning Petrochemical University, Fushun 113001, China.

**Abstract:** The network resource is rich in content and fast in updating. It is an inevitable trend to apply the network teaching resource database in the teaching process. Based on the analysis of the basic requirements, typical application cases and existing problems of the selection of network resources in the course of “Engineering Drawing Foundation”. This paper exemplifies the application cases of commercial Cad network resource database, open national standard database, etc. in the teaching of engineering drawing, providing reference for strengthening the teaching auxiliary role of network resource database, and promoting the network resources to better serve the actual teaching.

**Keywords:** Engineering Drawing Foundation; Network resources; Course Teaching Method; Courseware Resource; Pedagogy

Network education is not limited by time and space, and has changed the previous education mode. Students can learn through the network, which can reflect the main position of students, and the learning mode is more convenient. There are various visualized teaching materials in the engineering drawing course resource database, which can improve the classroom teaching intuitiveness. For example, students can use animation and video to demonstrate the drawing process of the drawing software while watching. The teacher uses animation to help explain the key and difficult points of the drawing knowledge, which makes it easier for students to understand, enhance their self-confidence, and cultivate their independent learning ability. Taking the teaching of the course engineering drawing foundation as an example, this paper summarizes the experience in the use of network resources and provides a reference for expanding its application in teaching.

## 1. Requirements in selecting network resources for the course engineering drawing foundation

The course engineering drawing foundation covers the theory of descriptive geometry, mechanical drawing, technical drawing standards and technical specifications. There are a large number of resources related to engineering drawing in the network can be used in the course teaching, and students can consolidate and improve their professional knowledge under the guidance of teachers. When selecting network resources, the following requirements should be taken into considered.

### 1.1 Abundance in mechanical part/assembly model resources

The course engineering drawing foundation is to solve space geometry problems. It plays an important role in cultivating students' ability to communicate mechanical design ideas, and students should be trained by a certain amount of exercises, which determines that the teaching process of drawing should focus on mechanical parts, assembly, etc. In order to figure out the lack of rich teaching resources in the offline teaching process, the network resource library should have a wealth of mechanical parts/assemblies models, with good interactivity. It should be convenient for students to analyze the modeling method of typical real mechanical product model, and provide materials for understanding the design ideas of mechanical parts, train the ability to read and draw drawings, etc.

### 1.2 Broaden students' professional vision

Through the reference of domestic and foreign resources, students can broaden their professional vision and fully understand the consistency and difference of the expression of graphics at home and abroad. Students can make full use of the network CAD model resource library to get familiar with the functional characteristics of the product. Teachers can demonstrate the direct application of the course through specific cases, which can lead students to quickly enter the professional field. Visual experience and quick understanding are conducive to future professional learning.

### 1.3 Convey correct professional values

The attitude and character that students pursue excellence in study or future work is the embodiment of professional ethics, professional ability and professional quality. Inheriting the craftsmanship spirit of dedication, excellence, focus and innovation is also extremely important for course teaching. When selecting network resources, it is necessary to cultivate students' engineering awareness, standardization awareness and professional habits, which is also one of the important curriculum objectives of engineering drawing foundation.

## 2. Typical application cases of network resources in drawing course Teaching

In the teaching process of engineering drawing foundation, teachers usually require students to complete the drawing work through manual mapping or computer aided design applications. In the conventional teaching process, there are not many real products as teaching aids. Moreover, students often only see real objects, but design drawings and CAD models of products are often not provided. Network resources are different, there are a large number of free drawings or digital models available for browsing or downloading, and they are interactive and can be observed from multiple perspectives, inside and outside at multiple levels. Combined with the content of the course of drawing, the appropriate introduction of network resources in the course teaching can not only improve the teaching effect, but also make it

easier for students to understand the teaching objectives of the course.

### 2.1 Typical Application in the Teaching of Basic Projection Theory

In the offline teaching process, the deduction using real-time drawing and interpreting on blackboard conforms to the students' cognitive laws, it helps to expand the students' rational thinking, and improve the students' logical reasoning and conception of the projection measurement relationship and the spatial orientation relationship. But for a long time, the lack of space imagination has been restricting students' understanding of technological drawings. The introduction of network resource library of mechanical parts into the classroom is helpful to solve the problem of abstract drawing teaching.

Many machinery related enterprises at home and abroad publish CAD models of products and important parts on the trading platform to provide classified retrieval, as shown in Figure 1. While it is convenient for customers to purchase and conduct comparative analysis, it also provides students with rich learning resources. For example, when explaining the assembly drawing, you can select the hydraulic cylinder from the online model library shown in Figure 1 as an example to understand the basic functions and working principles of the machine, and then display the projection of the basic view in the CAD model area shown in the figure, and observe the internal structure and matching relationship in combination with the section plane. Teachers and students jointly discuss the expression methods and dimensions of assembly drawings, which is helpful for students to establish the knowledge system of drawing, understand the mutual conversion between drawings and bodies, and improve the ability of configuration design. The introduction of real machine parts cases is also convenient for explaining the application of basic drawing knowledge, the use of CAD three-dimensional views and sectional functions to display the shapes of parts in different directions can increase the intuition of parts design, help students to read drawings and understand the structure of parts, and play an auxiliary role in improving students' spatial imagination and reading ability.

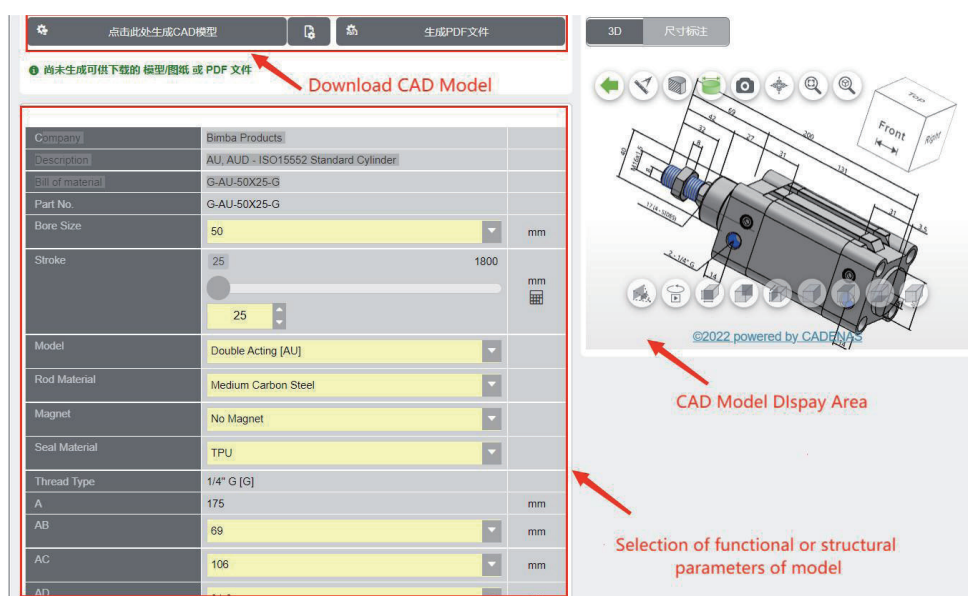


Figure 1. Typical mechanical parts resource library

### 2.2 Application in teaching standard parts and commonly-used parts

In the components of mechanical equipment, standard parts and commonly-used parts account for a large proportion. Such as keys, pins, bearings, etc., their models and naming rules are complex. It is more practical for students to "choose" than to "draw". In the conventional teaching process, more emphasis is placed on the conventional representation drawing of standard parts or commonly-used parts. In fact, it is advisable to lead students to enter the online mall as users online. As shown in Figure 1, by switching the display mode, the product physical image, performance, model, parameter configuration, etc. of the standard parts or commonly-used parts actually are displayed in the preview area, and the details of the parts can be observed, which makes it easier to establish a intuitive understanding of parts.

### 2.3 The Application in drawing standards teaching

This course involves a lot of national standards, and the standards related to drawing can refer to the "National Standard Full Text Public System", which is published by the National Standards Commission and is authoritative, timely and convenient. As shown in Figure 2, it is the representation of the section area in the national standard. Through online resources, students can have a new understanding of the standard number, standard status and standard replacement. In addition, the website also provides technical documents for comparison and analysis with European Union, Russia and other standards, which is conducive to broadening the horizon, and is of practical significance for training students to understand the role of standards, establish a sense of norms, and establish professional quality to comply with standards.



Figure 2. National standard full text disclosure system

### 3. Problems in the application of network resources to teaching

The correct use of network resources can support the teaching of engineering drawing foundation, but the existing problems should also be fully emphasized.

#### 3.1 The inconsistency of the main orientation of network resources with the teaching requirements

The network resources mentioned in this paper mainly refer to the display of product performance and principle developed by the industry or enterprise for the public. The main audience group of its design orientation is not students. The difference in orientation will affect the utilization of net resources for college teachers and students. For example, the commercial CAD resource library usually provides a large amount of information to customers for the convenience of their selection of demonstration products, which is not only related to drawing knowledge, but also random in the expression of geometric information. The lack of preparation for systematic professional training may lead to confusion of learning content and loss of focus of learning. The inconsistency between online resource orientation goals and teaching needs will not be beneficial to the learning of the drawing course if it is not carefully identified and guided.

#### 3.2 Higher requirements for students' self-control ability and professional interest cultivation

For teachers, to use appropriate network resources, teaching design requirements are higher. On the one hand, a lot of net resource library searching and selection should be done, and the professional, scientific and applicable online resources to be selected should be comprehensively and correctly evaluated and understood; On the other hand, teachers also put forward higher requirements for classroom management ability. Online resources not only provide professional knowledge, but also are full of various miscellaneous information. How to focus on learning for the attraction of other information is also one of the difficulties of online learning. At present, in the teaching process, establishing a good classroom learning atmosphere is an effective way to prevent learning interruption. Online learning in offline teaching also requires teachers' participation and guidance at any time, such as real-time assessment and communication, and effective teaching management around learning content and objectives.

#### 3.3 Impact on the seriousness of classroom teaching

From a macro perspective, the network resource information is scattered, disordered, and non-standard, with a high degree of dynamic and random, frequent changes and changes. Its use process not only brings flexible and vivid classroom teaching, but also has a certain impact on the seriousness of classroom teaching. For example, in the CAD resource database, the view expression method that does not conform to the national standard, the dimension is not standardized, the technical requirements are considered less, and the pattern format is random. For the college students who are beginning to learn the course of engineering drawing foundation, the negative impact cannot be ignored. In addition, most of the time and way of using online resources are arranged by students themselves, it is difficult for teachers to set assessment standards for students' learning status and quality, and it is also difficult to assess problems that may exist in learning, communication of teachers and students mainly depends on students' individual wishes. If they are guided by the wrong information in online resources without knowing themselves, the use of net resource will has poor effect on studying.

## 4 Conclusions

In the teaching of the course of engineering drawing foundation, the scientific and reasonable introduction of digital models of

mechanical parts in the network resource library will help students consolidate and improve their knowledge, guide students to deepen their professional knowledge, master the basic theory of drawing, and improve their ability to apply the knowledge to solve complex engineering problems. But at the same time, teachers should also have a clear understanding of the possible problems in this process. Network resources provide assistance for teaching from the perspective of sharing. However, from the perspective of network resource characteristics and content quality, it is recommended that teachers take it as an important supplement and expansion beyond classroom teaching and book knowledge, which should be recommended after careful evaluation and selection.

## Acknowledgements

This work is supported by Liaoning Provincial Undergraduate Education Reform Project Quality Teaching Resources Construction and Sharing Project “Research on the Application of the Mixed Teaching Mode of the Course of Engineering Drawing Foundation with Students-Centered principal”; Shenyang Agricultural University Education and Teaching Research Project “Construction and Practice of Quality Evaluation and Feedback Mechanism of Agricultural Mechanization Talents Training Based on Engineering Education Professional Certification” (2021-05-02)

## References

- [1] ZHANG Jian, Ren Y, Zhang H, Hou X. The Study on Online Teaching Mode Based on Multi - Platform Integration [J]. Journal of Changchun Institute of Technology (Social Sciences Edition), 2021, 22(03): 103–105.
- [2] ZHONG Xiaolei, LIU Pai. Discussion and Practice of Applied Undergraduate Curriculum Reform Based on OBE Concept——Take the Engineering Drawing and Computer Graphics as an Example [J]. Science & Technology Information, 2022, 20(02): 196-199.
- [3] SRICHAIYARAT P, LAO-AMATA P. Legal Education During COVID-19 Pandemic: An Experience of a Thai Law School [J]. Asian Journal of Legal Education, 2020(7): 230.
- [4] Renz K. Using OpenSky Data for Teaching Software Engineering to Undergraduates [J]. Engineering Proceedings, 2022, 28(1), 3.
- [5] Chang, Chin-Hsiang. Apply Discovery Teaching Model to Instruct Engineering Drawing Course: Sketch a Regular Pentagon [J]. Procedia - Social and Behavioral Sciences, 2012, 64(1): 457-466.
- [6] Jou M, Tennyson R D, Wang J, et al. A study on the usability of E-books and APP in engineering courses: A case study on mechanical drawing [J]. Computers & Education, 2016, 92(JAN.-FEB.): 181-193.
- [7] Yapici M, Koldemir B. Developing Innovative Applications of Technical Drawing Course at the Maritime Education [J]. Procedia - Social and Behavioral Sciences, 2015, 195: 2813-2821.
- [8] Gindis E. Spotlight On: Drafting, CAD Management, Teaching, and Consulting [J]. Up & Running with Autocad, 2017. 721-725.
- [9] Wesley Tsz-Kin Chan, Wen-Chin Li. Investigating professional values among pilots, cabin crew, ground staff, and managers to develop aviation safety management systems [J]. International Journal of Industrial Ergonomics, 2022, 9: 103370.
- [10] Fakhry M, Kamel I, Abdelaal A. CAD using preference compared to hand drafting in architectural working drawings coursework [J]. Ain Shams Engineering Journal, 2021, 12(3): 3331-3338.
- [11] CADENAS Partsolutions. ecatalogsolutions [EB/OL]. [2022-12-5]. <https://partsolutions.com/ecatalogsolutions/download-3d-cad-models/>.
- [12] Lorenat J. Drawing on the imagination: The limits of illustrated figures in nineteenth-century geometry [J]. Studies in history and philosophy of science, 2020, 82: 75-87.
- [13] Cohen K, Katz R. Teaching Mechanical Design Practice in Academia [J]. Procedia CIRP, 2015, 36: 177-181.
- [14] Brigida B, Franca G, Marina M, Roberto Raffaeli. Shape and Context-Based Recognition of Standard Mechanical Parts in CAD Models [J]. Computer-Aided Design, 2023, 155: 103438.
- [15] Standardization Administration of the P.R.C.. Mechanical drawings—Basic conventions for representing areas on cuts and sections [EB/OL]. [2022-12-5]. <https://openstd.samr.gov.cn/bz/gk/gb/newGbInfo?hcno=7E48457ABE06799AEBFB9E7C8651BF63>
- [16] J.A. Naslund, K.A. Aschbrenner, S.J. Bartels. How people with serious mental illness use smartphones, mobile apps, and social media [J]. Psychiatric Rehabilitation Journal, 2016, 39 (4): 364-367.