



# Research and Practice of Application Undergraduate Three-Dimensional Course Resources under the Background of Informatization

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**Abstract**—Application undergraduate education has played a positive role in promoting economic and social development and promoting the popularization of higher education. Under the background of the continuous improvement of the level of informatization in the new era, through the research, construction and practice of three-dimensional teaching resources, we will promote the reform of the training mode and professional teaching mode of applied undergraduate education talents in colleges and universities, improve teaching efficiency, further improve the quality of education and teaching, and cultivate high-skilled compound and innovative talents required by the era for the society. This paper analyzes the construction of three-dimensional teaching resource library for applied undergraduates, expounds the opportunities and challenges brought by information technology to applied undergraduates, puts forward the characteristics of the construction of applied undergraduate resource library, studies the construction and practice of applied undergraduate resource library based on informatization, and puts forward suggestions for construction.

**Index Terms**—Application undergraduate, Curriculum resources, Informatization, Three-dimensional



## I. INTRODUCTION

Informatization brings rich learning resources and convenient means of information exchange and storage. In the information age, a large number of resource platforms, massive learning resources, and fast information exchange means provide learners with opportunities to learn anytime, anywhere. In the era of big data, digital teaching resources are rich in content, including text, images, sound, animation, video and other media elements, and the same knowledge content can be presented in various ways. In addition, according to the organization form of knowledge content, it can be divided into text materials, courseware, teaching videos, teaching cases, exercises, etc. Students can learn a variety of learning resources without leaving home, and they can learn anytime, anywhere. This is an opportunity for every college student, and learning is no longer limited to borrowing and buying books.

While informatization brings us convenience, it will also have some deficiencies. First of all, there are many kinds of learning resources in the information age, and the quality is uneven, and there are too many learning resources for the same knowledge content, which is difficult to choose. As a student, because he is in the learning stage, he has an inaccurate grasp of the overall knowledge he has learned, and he cannot distinguish between high-quality learning resources and inferior resources, and is easily delayed or misled by inferior resources. Secondly, due to the rapid replacement of computer software and hardware, the digital teaching resources are updated and eliminated quickly, and because some resources are not eliminated or replaced in time, it will cause the coexistence of expired resources and current resources, which will cause trouble to learners. The current problems in the construction of application-oriented undergraduate teaching resource library are:

1. Heavy construction, light application, insufficient sharing

The ultimate purpose of resource library construction is application, which is to improve learning efficiency and improve teaching effect. To this end, the competent departments at all levels of education and all kinds of schools have invested a lot of manpower, material and financial resources in construction, and the construction has also been completed and passed the acceptance as required. However, the later application is insufficient and lacks maintenance. In addition, digital resources are updated relatively quickly, so the teaching resources built are abandoned over time. Due to the characteristics of digital resources, the construction of teaching resource library has always advocated the principle of sharing, but due to economic conflicts of interest and enterprise participation in construction, sharing is not sufficient, and there are problems such as paid sharing.

2. Construction is blind and not targeted

With the popularization of the Internet and mobile intelligent terminals, online mobile learning is becoming more and more common, and the demand for resource library

construction is increasing, and various online learning platforms also encourage teachers to produce online teaching resources. All types of schools at all levels widely carry out online teaching, using a variety of teaching platforms: WeChat group, QQ group, DingTalk group, wisdom tree, cloud class, learning pass and so on. Teaching methods include interactive teaching, live teaching, online course building teaching and so on. Due to the variety of teaching platforms and diverse teaching forms, teaching resources are also very abundant. However, due to the construction of resource library, it is often not like software development, following the idea of software engineering, lacking early requirements analysis, or insufficient demand analysis, no specific student population, lack of academic analysis, and no strict operation and maintenance in the later stage, and resources have not been strictly reviewed. In this case, the resource quality and application effect will not get real feedback, and the resource quality cannot be continuously improved.

3. Duplicate construction, unscientific resource classification, unreasonable management, and insufficient types of resources

Due to the open nature of the Internet, anyone can upload educational resources to the Internet, so the same topic can find a large number of resources in the network. Since there is no uniform specification for teaching resources, although the amount of data is large, the quality of these resources is uneven. In addition, the resources of many online courses focus on teaching videos and teaching courseware, and lack animation resources and case materials, which cannot fully meet the learning needs of students. At the same time, due to the huge amount of resource data, it also brings difficulties to the organization and use of resources, and it is difficult to organically integrate high-quality resources. Due to the above problems, it is difficult for teachers and students to obtain the best teaching resources in theory.

4. The collection of materials, heavy accumulation, lack of integration, uneven quality, cannot reflect the characteristics of application-oriented undergraduates

In the information age, teachers are not only users of resources, but also builders of resources. Since there is no unified standard, the level of construction is uneven, and the release of resources is also open, so various resources are flooded, and the quality is also very different. With the same theme, you can find a variety of different resources on the network, some resources are of acceptable quality, and some resources can be said to be a simple combination of materials, lack of optimization and integration, and the quality is miserable. In addition, when building resources, the characteristics of application-oriented undergraduates are not highlighted, and some courses with similar course names may have general teaching resources for higher vocational and applied undergraduates.

5. Failure to timely feedback on resource quality and slow resource updates

The construction of the teaching resource library of



colleges and universities is often led by teaching teachers and built according to mainstream teaching materials and syllabuses, that is to say, the construction of teaching resource libraries is highly dependent on teaching materials and syllabuses. Once the resources are built, they are put into operation for learners to learn. Often after the construction of the resource library, there is no good quality feedback mechanism, often through the "click rate" and "number of course selection" to understand the use of resources, without collecting feedback from users, and lack of accurate follow-up of industry dynamics, resulting in many resource libraries as auxiliary "material libraries" in the teaching process. [8] discussed about specific Policy document which ensures of which the teaching, learning in addition to assessment methods are upwards to the amount of typically the course and are ideal to the attainment involving objectives and intended understanding outcomes of the program and the course. The particular policy requires that school members use recent in addition to variety of teaching, mastering methods and assessment methods. Higher Quality Accredited Institutions will continue to further more improve the standard involving teaching and learning via recognition, sharing and moving of good practices to be able to inspire the learners to be able to achieve their potentials throughout a multicultural environment in addition to in turn, improve accomplishment, retention and learners pleasure. [9] examined the development and refinement of possible mathematical models for the intellectual system of career guidance. Mathematical modeling of knowledge expression in the career guidance system, Combined method of eliminating uncertainties, Chris-Naylor method in the expert information system of career guidance, Shortliff and Buchanan model in the expert information system of career guidance and DempsterSchafer in the expert information system of career guidance method has been studied. The algorithms of the above methods have been developed. The set of hypotheses in the expert system is the basic structure of the system that determines the set of possible decisions of the expert system. This set, which is crucial in decision-making, should be sufficiently complete to describe all the possible consequences of situations that arise in the subject area. Therefore, it is important to improve the mathematical models of the intellectual system of career guidance.

## II. THE SIGNIFICANCE OF THE STUDY

Higher education informatization is an important content of education informatization, an important task of basic capacity building of higher education, an important foundation for supporting the reform and innovation of higher education, and a key link to improve the quality of talent training. The construction of informatization teaching resources plays an important role in the curriculum teaching reform, talent training mode and teaching method innovation of undergraduate schools.

Based on the background of informatization, the effective strategies and mechanisms of the construction and

application of three-dimensional teaching resources must be derived through the practical and effective practice of teachers. On the basis of information technology, with the help of three-dimensional teaching resources, break through the shackles of subject exploration of traditional teaching mode, and break the traditional "teacher-centered, classroom-centered, book-centered" teaching mode. Through the use of modern educational technology means and methods, create an open and shared teaching environment, establish the awareness of serving student development, and explore the construction of a new interactive learning mode under the guidance of the teaching philosophy of "teacher-guided, student-oriented", improve the quality of education and teaching, and promote education and teaching reform. Adhering to the concept of lifelong development of students, respecting students' individual differences, attaching importance to the acquisition of students' basic knowledge and skills, and cultivating students' ability to collect, process and effectively use information.

Through participating in the independent research and development of three-dimensional teaching resources, teachers can put forward questions, ideas and ideas according to the actual teaching, trigger continuous thinking and reflection, and provide teachers with a platform for teaching and research, curriculum development and academic exchanges, which is conducive to improving teachers' curriculum research and development capabilities.

Create a good information-based network learning environment, extend classroom learning to extracurricular, effectively play the main role of students, change students' learning styles and learning habits, improve students' awareness and ability of independent learning, cultivate students' interest in learning and multi-level inquiry learning ability, and improve students' learning efficiency and innovation ability.

## III. RESEARCH ON THE CONSTRUCTION OF THREE-DIMENSIONAL CURRICULUM RESOURCES

### A. Research content

(1) Investigate the training goals and job talent needs of applied undergraduate majors in colleges and universities, correspond to the core vocational capabilities, design the content of the core courses of the major, reconstruct and decompose, carefully sort out and screen, and determine the focus, difficulties, doubts and other contents of each course.

(2) Determine the three-dimensional teaching resource construction plan for the core courses of applied undergraduate majors in colleges and universities, determine the form of resource presentation according to the characteristics of knowledge points, and build three-dimensional teaching resources including micro-courseware, animation, video, classroom recording, software simulation and so on.

(3) Research and development of new three-dimensional teaching materials for applied undergraduate core courses in colleges and universities.



### B. Research objectives

(1) Develop multi-level dynamic three-dimensional teaching resources and three-dimensional teaching materials, in line with the characteristics and cognitive laws of undergraduate students, and build a smart and efficient classroom inside and outside the classroom.

(2) Explore the strategy of building three-dimensional and high-quality teaching resources for the core courses of applied undergraduate majors in colleges and universities, and build a new online teaching mode based on three-dimensional resources. Combine education and teaching reform with the research and development of teaching resources to cultivate students' awareness of independent problem solving and the ability to innovate and explore.

(3) Promote the wisdom collision and information transmission among teachers of application-oriented undergraduate majors in colleges and universities, and communicate with each other, complement each other's advantages, and improve together in the process of construction and application of three-dimensional teaching resources. When preparing lessons, teachers can obtain the required teaching materials through the network query, process and use them according to their own teaching characteristics, and students can conduct self-study through the network or repeat and consolidate the difficult points and doubts, so as to further improve the quality of education and teaching.

### C. Key issues to be solved

(1) Combined with the needs of enterprises and the characteristics of schools, redesign the course structure, integrate course content, sort out important knowledge and skill points, develop three-dimensional teaching resources that conform to the cognitive characteristics and laws of undergraduates, solve the problems of outdated information-based teaching resources of applied undergraduate majors in colleges and universities, dependence on external procurement, poor matching with teaching materials, and clutter and impracticality, and improve the quality of teaching resources.

(2) Research and development of new three-dimensional teaching materials to achieve the consistency of teaching materials and teaching resources. At the same time, it enhances the attractiveness of teaching materials and solves the situation that the traditional teaching materials form is single and boring.

(3) Through the research and development of three-dimensional teaching resources, fully mobilize the enthusiasm of teachers, stimulate the enthusiasm of scientific research, effectively solve teachers' burnout, and devote themselves to the reform of education and teaching in the information age.

## IV. THE IMPLEMENTATION OF THE CONSTRUCTION OF APPLICATION-ORIENTED UNDERGRADUATE RESOURCE LIBRARY BASED ON THE BACKGROUND OF INFORMATIZATION

### A. The construction of resource banks should grasp professional characteristics

For example, science focuses on theoretical teaching, engineering focuses on engineering practice, and art focuses on the display of achievements. This requires reasonable organization of teaching resources according to professional characteristics. Undergraduate teaching focuses on inspiration and guidance, so in the construction of the resource library, in addition to organizing the knowledge content in the course syllabus, it is also necessary to expand the knowledge modules horizontally and vertically, mainly considering the transfer and application of knowledge horizontally, and vertically deepening the depth of knowledge to guide students to independently carry out in-depth learning, improve the level of knowledge application, and also prepare for further study. In addition, due to the need for application-oriented undergraduates to cultivate application-oriented talents, students must carry out more comprehensive practice. Due to the relative lack of practice bases in the school, and the practice facilities and equipment generally lag behind the facilities and equipment of enterprises, they will also lag behind the technical level of first-line enterprises at the technical level. School-enterprise cooperation is a good way to resolve this contradiction. Schools and enterprises cooperate in production, technology research and development, and curriculum resource development, forming a virtuous circle and achieving the purpose of win-win between schools and enterprises.

### B. The construction of resources is adapted to students' learning needs

Learning resources are intended for students. Resources that can meet the needs of students and are recognized by students are high-quality resources. In the construction of traditional resource libraries, the disconnect between builders and users is serious, there is a lack of academic analysis, and there is a lack of user feedback, so the quality of resources cannot be accurately evaluated. Using information technology, valuable information is extracted from the learners' online learning information records, practice scores and other information, which can provide reference for teaching personnel and resource library construction personnel, and facilitate the optimization and improvement of resources.

### C. Resource integration

Under the background of informatization, the integration of application-oriented undergraduate teaching resources is very important. The construction of the resource bank cannot be carried out according to the production mode of individual workshops, and cannot be built in isolation from others, otherwise it can only add a little broken tile to the vast ocean of resources. Resource construction should have unified planning and deployment, and integrate personnel resources, information resources, and platform resources.

#### (1) Integrate platform resources

Teaching resources need to provide interfaces through the platform to fully reflect the availability of resources and



facilitate learners to view. Traditional teaching resources generally upload resources to the web server and spread to learners through web pages, and the collection, collation and upload of resources need to be completed by more professional personnel. With the popularity of mobile learning, more and more platforms provide services that integrate resources. Resource integration is no longer something that professionals can do. Numerous resource platforms bring great convenience to teachers and students, but also bring confusion. The proliferation of resource platforms makes teachers and learners spend a lot of time and energy between various teaching platforms. No single platform can meet all requirements, but not more platforms are better. Only by integrating platform resources and forming complementary advantages of platform resources can we bring greater convenience to teachers and learners.

#### (2) Integrate human resources

The construction of the resource library is not a simple accumulation of resources built by each individual, but should integrate teachers according to subject categories and courses, establish a scientific and reasonable overall planning mechanism, and make reasonable arrangements for the division of labor, so as to produce high-quality teaching resources. For example, theoretical teacher resources, experimental practice class teacher resources. Through the analysis of teacher categories, resource categories and undergraduate professional skills through big data, the most suitable teachers are selected to form a resource construction group.

#### (3) Integrate information resources

In the context of informatization, information resources must be fully integrated in order to present high-quality resources to learners. Before producing teaching resources, it is necessary to fully understand the domestic and foreign development level, professional development trend, curriculum development and the scope of use of teaching resources of relevant knowledge content, fully screen teaching information resources, and adjust teaching resources according to the needs of professional positions and professional capabilities. In addition, since the training program and syllabus are frequently updated, the integration of the resource library should also be in line with the teaching objectives of the training program and the knowledge content in the syllabus. Therefore, it is necessary to pay attention to the maintenance and integration of the teaching resource library, so that the teaching resource library presents different integration effects according to the needs of students.

#### D. Project innovation

Embed self-developed three-dimensional digital resources into paper textbooks in the form of QR codes, develop new three-dimensional teaching materials, and target "people who want to learn", break through the constraints of time and space, and make learning happen anytime, anywhere. The self-developed three-dimensional teaching resources are diverse in form and intuitive image, fully mobilize students' multiple senses, stimulate students' interest and enthusiasm for learning, and make efficient use of resources. Three-dimensional teaching resources are researched, constructed, practiced, revised and improved, through

cooperation and exchange, wisdom collision, to achieve the co-construction and sharing of high-quality resources, help teachers grow together, and reduce teachers' burden of lesson preparation.

Through research and practice, on the one hand, improve the education and scientific research level and scientific research awareness of professional teachers, and achieve major breakthroughs in teachers' teaching concepts, teaching methods, and teaching design ideas. On the other hand, three-dimensional teaching resources are abundant, and three-dimensional teaching materials are vivid and lively, stimulating students' interest in learning, improving learning effects, breaking through the time and space limitations of learning, and knowledge transfer reflects the multilateral interaction of teachers, students, teaching materials and resources.

#### V. THE CHARACTERISTICS OF THE CONSTRUCTION OF APPLICATION-ORIENTED UNDERGRADUATE RESOURCE LIBRARY

##### A. Attaching equal importance to theory and practice

The cultivation of application-oriented undergraduate talents should first follow the educational law of undergraduate talent training, and at the same time highlight practice and strengthen application. It cannot be because it is to cultivate undergraduate-level talents, but simply follow the education model of ordinary undergraduates and run a discipline-based and research-oriented undergraduate; At the same time, the teaching of basic theories should not be rudely weakened in order to highlight the application, but should complement each other and promote the strengths and avoid the weaknesses. In other words, applied undergraduate education can neither be theoretical enough, focus on practice, nor can it attach the same importance to theoretical research as research undergraduates.

##### B. Application-oriented

In terms of talent training specifications, application-oriented undergraduate cultivates not academic, discipline-based, and research-oriented talents, but cultivates high-tech application-oriented talents who meet the needs of social and economic development, serve economic construction, are familiar with project management, and meet the front-line needs of social services. In terms of training mode, the application-oriented undergraduate aims to meet the needs of society, designs students' knowledge, ability, quality structure and curriculum system with the cultivation of applied technology ability as the main line, builds the teaching content system with "application" as the main purpose and characteristics, and attaches importance to the cultivation of students' technical application ability.

##### C. Learning-centered

The purpose of resource library construction is to facilitate learners' learning and provide suitable learning resources and platforms. For undergraduates, they have strong self-learning ability and discrimination ability, and have high requirements for the quality and quantity of digital resources. Therefore, the construction of application-oriented undergraduate resource library must be centered on learning, and build a



high-quality resource library to meet the learning needs of undergraduates.

#### VI. SUGGESTIONS FOR THE CONSTRUCTION OF THREE-DIMENSIONAL TEACHING RESOURCES

##### A. Establish and complete project organizational structures

###### (1) Assemble a project work team.

Absorb a group of like-minded outstanding professional backbone teachers to form a project work team to undertake the specific task of building three-dimensional teaching resources. The project not only plans as a whole, but also formulates specific tasks according to the personal strengths of members, reasonably divides labor, maximizes the individual wisdom of team members, taps the inherent potential, and enables members to grow continuously in the tempering. The working team held a seminar to normalize and institutionalize, and members contributed their ideas, worked together, collided with the spark of thinking, jointly studied the methods to solve problems, and resolved the problems and confusions encountered in the research.

###### (2) Establish a project leadership group.

The school has set up a leading group for special project work, fully mobilized school resources, effectively coordinated the work of various departments, and coordinated the organization, management and promotion of the project.

###### (3) Establish a project expert group.

Senior professors, scientific research experts of research institutions, management personnel of industry enterprises and technical backbones are hired as members of the expert group, responsible for formulating relevant standards for the construction of three-dimensional teaching resources, reviewing the scientificity, forward-looking and feasibility of the course content related to the construction of three-dimensional teaching resources, assessing and evaluating the three-dimensional teaching resource courses, and strictly controlling the quality of the project from the source.

##### B. The objectives are clear and the plan is specific and feasible

(1) Organize the structure and content of the core courses of applied undergraduate majors, and determine the basic information of courses, teaching forms, key and difficult points of teaching content and basic resources of courses. Begin to carry out the systematic design of three-dimensional teaching resources, including curriculum structure and resource structure design.

(2) Division of labor and cooperation to develop teaching resources such as micro-courses, teaching videos, classroom records, animation, teaching design, teaching courseware, learning work pages, project process cards, typical cases, practice questions, and test question banks. The fourth step is to reintegrate the teaching content, design the teaching project, embed the three-dimensional teaching resources in the form of QR codes into the paper teaching materials, and compile new three-dimensional teaching materials.

(3) Design questionnaires on the use of teaching resources and current teaching materials, conduct research on teachers

and students, consult relevant literature, and design research plans.

##### C. Establish an effective mechanism for project management

(1) Pay attention to the condensation of results and formulate incentive mechanisms. Encourage project team members to summarize and refine research results, write summary reports, research papers, write typical cases, and publish three-dimensional teaching materials for teaching reform and innovation.

(2) Strengthen process management. Regularly carry out exchange seminars to understand the progress of the project, exchange experience, share experience, and organize and file process materials.

(3) Establish a dynamic management mechanism for teaching resources. After the construction of teaching resources is completed, actively promote and apply, widely collect feedback and rationalization suggestions from users of teaching resources, carefully analyze feedback information, timely update, adjust and improve teaching resources, and improve practicality and effective utilization.

#### VII. CONCLUSION

Applied undergraduate majors are majors opened by colleges and universities, with wide coverage, high degree of professional relevance, and the methods and strategies formed by three-dimensional teaching resource construction and applied research can be transplanted to other majors to achieve common development and improve the quality of talent training in schools. At the same time, the research and development of new forms of three-dimensional teaching materials can also provide high-quality professional resources and services for social personnel and enterprise employees outside the school. The establishment of an informatization teaching resource database is the general trend of education informatization, and an important measure to promote education and teaching reform and improve teaching quality. The extensive use of teaching resource libraries in application-oriented undergraduate teaching is determined by the characteristics of application-oriented undergraduates, and it is not only necessary to vigorously promote and use, but also to use well. Therefore, all application-oriented undergraduate colleges and universities should use information tools to scientifically arrange and rationally arrange the teaching resource library, so that the teaching resource library can play a full role in teaching.

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#### REFERENCES

- [1] G. Chen, X. Sun, S. Zou, "Three-dimensional teaching material construction and hybrid teaching practice -- taking computer foundation and MS Office advanced application course as an example," Education Information Forum, 2021 (08): 7-9.
- [2] Y. Cui, "Three-dimensional textbook design and development based on information development," Heilongjiang Science, 2021, 12 (07): 136-137.



- [3] J. Guo, Y. Gao, D. Huo, Y. Liu, "Research and development of three-dimensional teaching materials based on augmented reality technology," *Journal of Liaoning Normal University (Natural Science Edition)*, 2022,45 (04): 480-486.
- [4] Y. Hao, Y. Wang, H. Yan, C. Xu, R. Guo, Z. Xu, "The construction of three-dimensional teaching materials in the context of educational informatization - taking diagnostics of traditional Chinese medicine (digital course) as an example," *Modern distance education of traditional Chinese medicine in China*, 2023,21 (04): 186-188.
- [5] T. Liu, Y. Liu, R. Yang, "Three-dimensional teaching material construction under the background of first-class courses -- taking the textbook "University Computer" as an example," *Heilongjiang Education (Higher Education Research and Evaluation)*, 2022 (05): 37-39.
- [6] G. Zhang, "Research and practice on the construction of three-dimensional teaching materials in higher vocational education under the background of information teaching -- taking the course of "electromechanical operation of hydropower station" as an example," *Teacher*, 2021 (31): 90-91.
- [7] Y. Zhang, R. Chen, W. Liu, X. Qin, W. Shi, "The development and practice of three-dimensional teaching materials of local culture in the context of information technology innovation -- taking the Good Wind in Xiangyang as an example," *Science and Technology Communication*, 2022, 14 (02): 129-131.
- [8] Christo Ananth, "Policy Document on Teaching, Learning and Assessment in Higher Quality Accredited Institutions", *International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)*, Volume 5, Issue 2, February 2018, pp:27-31.
- [9] Christo Ananth, A.R. Akhatov, D.R. Mardonov, F.M. Nazarov, T. AnanthKumar, "Possible Models and Algorithms for the Intellectual System of Professional Direction", *International Journal of Early Childhood Special Education*, Volume 14, Issue 05, 2022, pp. 4133-4145.

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