

# VIRTUAL SIMULATION-BASED REFORM OF APPAREL CURRICULUM

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**ABSTRACT** – With the rapid development of modern science and technology, computer technology has been widely used in various industrial fields of society, and the education industry is no exception. The application of virtual reality technology in clothing design has greatly improved the efficiency of designers in the redesign process and perfected the wearing effect of clothing. In the face of the future demand for innovative design talents, cultivating talents who meet the requirements of clothing design is an important issue and task for university teaching. At present, there are problems in the teaching of clothing design profession such as single traditional teaching mode, weak creativity of students' works, disconnection between teaching content and practice, imperfect teaching resources and imperfect teaching details. In this paper, virtual reality technology is introduced to reform the curriculum system of the clothing profession through a mixed research approach, using experimental project-based teaching combined with quantitative research methods. Through practice, it is proven that the integration of virtual technology into apparel teaching creates a simulation effect for teachers and students that cannot be matched in the traditional apparel design teaching process and enhances students' interest in learning. The application of virtual reality technology is a new and efficient teaching method that has emerged in recent years with the development of computers, combining technology and art, and based on the teaching of clothing design projects, which greatly improves learning efficiency and teaching effectiveness and can effectively improve students' innovation ability, and has a broad development prospect.

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## INTRODUCTION

In recent years, the apparel industry has become highly competitive, and higher education institutions that deliver talents for apparel enterprises are also facing difficulties and bottlenecks in professional talent training and curriculum teaching. Due to the progress and changes in apparel design and production processes, some students trained under the previous professional education model often find it difficult to adapt to the new industry requirements in a short period of time. Based on this, the apparel majors actively seek ways to dovetail teaching with the market, combine new digital technologies, and explore strategies and ways to transform applied technology-based disciplines. The current professional course teaching has a single teaching mode, insufficient or backward practical training sites, high requirements for the size of the site and equipment of the apparel practical training base, and large investment, and the practical training base under the school-enterprise cooperation mode is affected by the strength of the cooperative enterprises themselves, which has the problems of unstable project cooperation and difficult transformation of results (Wang,2022). Coupled with the rapid technological update of apparel professional equipment, the relatively limited number of enterprises that can invest in equipment in schools, also directly affects the teaching results of the apparel profession.

With the rapid development of computer technology, apparel virtual design technology has become more and more practical, and the scope of application in the apparel field is becoming more and more extensive. Clothing virtual design system can not only save design and boarding time, but also can virtually display the clothing on the human body wearing effect both to save time and save costs, while being able to achieve virtual fitting, virtual dynamic display, etc (Li&Li ,2021) .

## **PROBLEM STATEMENT**

Traditional teaching mode is single. In recent years, clothing professional teaching has been trying to reform the teaching content, teaching methods and teaching conditions, but by the school practical training conditions, financial investment, school-enterprise cooperation and many other reasons, it is difficult to really carry out some project practice teaching. In the teaching process, the teaching methods are traditionally cured, the practical projects are insufficient, and the assessment of teaching effect is single (Wang,2022) . And because the traditional teaching of garment profession needs a long process from design to plate making to garment making, students then under this lack of innovative teaching mode, some students gradually lose their interest in learning and lack of independent innovation awareness and ability (Tang & Hao ,2017).

The creativity of students' works is not very creative. In the teaching process of apparel majors, students first research apparel brands and markets, then complete trend predictions based on research results, and finally practice design. At present, in China, there is a lack of originality in apparel design, and most of the professional courses are taught using European and American brands as design cases, and the design works of students are not very creative and even out of market.

Course content does not fully integrate design. For example, in the teaching of "Material Reconstruction" course, the traditional teaching mode is that the teacher introduces the methods of material reconstruction and students practice a lot of material design (Wang,2022). In the learning process, students mastered certain methods of material redesign through learning and understanding of materials, but these material exercises are all small pieces of fabric design attempts without digital processing, and they cannot intuitively feel the integration of material redesign into clothing design works (Elfeky,2018). At best, students mastered the method of material reconstruction, but they were unable to really translate the effect creatively for later use in their garment design work. Therefore, in the teaching mode, art and technology should be integrated, and the application of virtual reality technology should be used to innovate the teaching mode and improve the quality of teaching.

Imperfect teaching resources. There is already a certain mode of school-enterprise cooperation and project-based teaching in the teaching of fashion design majors, but in the process of school-enterprise cooperation, the enterprise instructors do not participate in the whole learning and practice of students, but only give guidance in the process of graduation design or a certain project (Hindawi,2022). At present in China, there is no bridge between schools and enterprises to build a curriculum teaching system together, so students cannot really combine the latest development of the apparel industry with their design works (Ma,2017) . The imperfect teaching resources make the teaching process of teachers limited, which professionally leads to the hindrance of students' creative process and the inability of design works to be better accepted by the market.

Teaching details are not perfect. Fashion design students usually consume a lot of time on garment pattern making and production, students need to learn the pattern making formula and various garment sewing processes, the whole process of production is difficult and long, it is difficult to grasp the details of the garment precisely and the real final garment effect is difficult to grasp (Zhang,2020). In China, a design class is about 30 students, and the teacher does not have enough time for design coaching for each student on average, and cannot provide detailed guidance on the specific details of design, production process details, etc., resulting in most students' ready-to-wear works not being ideal.

In the era of Digital transformation, if we don't study this research, the clothing design industry can't keep up with the social development, and students' employment becomes more and more difficult, more and more enterprises provide 3d jobs to find designers who can use virtual technology (Wu & Chen,2021). The professional setting of vocational colleges is based on the positions provided by society, if the students can't meet the job requirements, It not only limits the development of the clothing industry, but also restricts the construction and development of majors in vocational colleges.

## **LITERATURE REVIEW**

Virtual reality (VR) technology has shown its great development potential in many industries. Combining Virtual reality (VR) technology with the game industry brings users a new game experience, as long as they put on the helmet, they can be in the game environment, without leaving home, they can

be in another space, which greatly reduces the danger of outdoor games; combining Virtual reality (VR) technology with engineering design, designers can show the design products in 3D interactive form in front of customers, allowing customers to more directly understand the product. Combining Virtual reality (VR) technology with medicine, medical students' learning of medical knowledge no longer stays in books or simple models, but can observe various organs or tissues up close through equipment, which not only improves teachers' teaching efficiency, but also increases students' opportunities for clinical experiments and for repeated experiments on the same case to a proficient level ..... Thus, it can be seen that Virtual reality (VR) technology has a wide range of applications and brings great benefits to all walks of life, which is reflected in the training of university talents, VR courses can be offered in science and technology, art, education and other majors, thus promoting the training of VR talents in various fields and promoting VR in The promotion and development of different industries.

Fashion design courses mainly rely on a series of skills. Virtual reality (VR) is an emerging technology that utilizes mobile and context-aware devices (e.g. smartphones, tablets) that enable participants to interact with digital information embedded within the physical environment (Dunleavy, 2014). It is a new technology that has emerged with potential for application in education (Saidin, Halim, & Yahaya, 2015) and enables users to enrich the real world with virtual content (Tesolin & Tsinakos, 2018). It also augments students' experiences in real-world environments by dynamically overlapping digital materials with a real-world environment (Elfeky, 2018; Wu, Hwang, Yang, & Chen, 2018) where virtual information corresponds to locations of real-world objects in or proximate to the current location (Sandberg, 2018). Numerous researchers have pointed out that Virtual reality (VR) has immense potential in the enhancement of learning and teaching (Bacca, Baldiris, Fabregat, & Graf, 2014; Bower, Howe, McCreddie, Robinson, & Grover, 2014; Cai, & Lee, 2017; Foster & Cunniff, 2016). It supports the smooth interaction between real and virtual environments and, in the same time, allows a tangible interface metaphor to be used for object manipulation (Singhal, Bagga, Goyal, & Saxena, 2012). Therefore, it is gaining popularity within society and becoming more ubiquitous in nature (Bower, 2014). Recently, it has matured enough and so its applications can be found in both mobile and non-mobile devices (Bacca, 2014). Nevertheless, few studies have been in the education field (Saidin, 2015). However, researchers and experts who promote the use of the Virtual reality (VR) technology claim that it provides learners with more opportunities to be more skillful and knowledgeable, to function, aesthetics and creativity. The design of skills and functions is very important. Because fashion designers design for others rather than for themselves, they should consider other people's needs, aesthetics, lifestyle, attitude, desire and so on, so as to design something more suitable for them. And aesthetic skills are very necessary to make fashion products more attractive and popular, and to better express attitudes and ideas. In addition, creative skills usually involve fluency, flexibility, originality and other elements, so fashion design is regarded as an innovative process, designers use inspiration to produce the best creative and artistic experience. Virtual reality (VR) technology can help fashion design students improve their skills in the field of aesthetics and creativity.

## **METHODOLOGY**

This study adopts a mixed research method, with experimental research method as the main method and quantitative research method as the supplement. The sample was selected from students of a higher education institution in Guangdong Province, China, majoring in apparel, and a questionnaire survey was done on virtual technology. Twenty second-year students (5 males and 15 females) were drawn. By changing the teaching content of apparel design, students understand the basic concept and terminology of virtual reality technology, master the application of virtual reality technology in apparel majors, cultivate students' creative consciousness and aesthetic quality, and have the ability of independent design, virtual sewing and virtual display. Comparisons were made in terms of creative thinking concept of clothing, overall shape of clothing style, use of creative elements, outer silhouette design, style design, color design, fabric design, and software application ability.

Qualitative research was conducted through a questionnaire survey of students and semi-structured interviews with apparel teachers and a corporate interview with a company dedicated to virtual reality technology for apparel professionals.

### **Research Design**

We set up an experimental group and a control group, The experimental group obtained a result through this traditional teaching method. After receiving virtual technology training, the control group will receive a result, and the two sets of data will prove the necessity of applying virtual simulation technology in vocational education. It improve students' creativity, creative thinking or design abilities, as well as their grasp of style design, color design, and other aspects.

## RESULTS

The sample data showed that the Pearson correlation coefficient was used to indicate the strength of the correlation. The specific analysis shows that the correlation coefficient value between whether using VR technology software in the apparel design classroom is helpful to design and whether receiving training about how to use virtual reality technology is 0.292 and shows a significance at 0.01 level, thus indicating that if using VR technology software in the apparel design classroom is helpful to design and receiving training about how to use virtual reality technology There is a significant positive correlation between training on how to use virtual reality technology.

**Table 1.** Pearson correlation - standard format

	Would you find it helpful if software with VR technology was used in the apparel design		
	Regression coefficient	95% CI	VIF
Constant	0.837** (6.409)	0.581 ~ 1.093	-
Do you receive training on how to use virtual reality technology?	0.188** (2.808)	0.057 ~ 0.319	1.001
Do you accept the future use of virtual reality as part of the apparel design classroom experience?	-0.012 (-0.119)	-0.216 ~ 0.191	1.001
Sample Size		88	
R 2		0.085	
Adjustment R 2		0.064	
F-value	F (2,85)=3.968,p=0.023		

Dependent variable:

If software with VR technology was used in the apparel design classroom, would you find it helpful for design?

D-W value: 2.015

\* p<0.05 \*\* p<0.01 t-values in parentheses

**Table 2.** Linear regression analysis

From the above table, it is concluded that whether or not to receive training on how to use virtual reality technology and whether or not to accept virtual reality as part of the apparel design classroom experience in the future are the independent variables, and whether or not to find it helpful to design if software with VR technology is used in the apparel design classroom is the dependent variable for linear regression analysis, and from the above table, the model equation is: If software with VR technology is used in the apparel design classroom, do you find it helpful to design technology in the software, do you

feel that it helps the design? =  $0.837 + 0.188 * \text{Do you receive training on how to use virtual reality technology} - 0.012 * \text{Do you accept the use of virtual reality as part of the apparel design classroom experience in the future}$  The model R-squared value is 0.085, meaning do you receive training on how to use virtual reality technology? , Do you accept the use of virtual reality as part of the apparel design classroom experience in the future? could explain whether you would find it helpful to design if software with VR technology was used in the apparel design classroom? The reason for the 8.5% change in the An F-test of the model revealed that the model passed the F-test ( $F=3.968, p=0.023<0.05$ ), which means that whether you receive training on how to use virtual reality technology? ,Do you accept the use of virtual reality as part of the apparel design classroom experience in the future? at least one of these would have an impact on whether you would find the software with VR technology helpful to design if it were used in the apparel design classroom? In addition, the test for the multiple cointegration of the model found that all the VIF values in the model are less than 5, which means that there is no cointegration problem; and the D-W value is around the number 2, thus indicating that there is no autocorrelation in the model, and there is no correlation between the sample data, and the model is better. The final specific analysis reveals that.

Do you receive training on how to use virtual reality technology? has a regression coefficient value of 0.188 ( $t=2.808, p=0.006<0.01$ ), implying that whether or not you receive training on how to use virtual reality technology? would have an effect on whether you would find it helpful to design if software with VR technology was used in the apparel design classroom? produced a significant positive influence relationship.

When VR technology is applied to garment teaching, the final effect will show the design diagram of traditional teaching and can see all angles of the garment in  $360^\circ$  in three dimensions. During the design process, the garment structure diagram (paper sample) can be generated directly, the visual effect can be modified and adjusted, and the garment can be sewn virtually; the different effects brought by the different characteristics of different fabrics can be seen intuitively, and the final result will be a virtual dynamic garment display that simulates the wearing effect of real people (Zhang, J, 2020 ).

Through the redesign of teaching content, the teaching effect has been significantly improved. Firstly, students' learning initiative has improved significantly, and we know through the survey that students are more interested in design; secondly, the quality of design works has improved, both in terms of creativity, style, color, fabric use and integration of paper pattern and wearing effect, which indicates that the teaching quality and students' learning effect have been improved significantly; students' satisfaction with the teaching content and teaching method has also improved, and the traditional process of making boards, sewing and modifying has been omitted, and students can see their designs more quickly and intuitively.

Virtual simulation technology teaching is a new teaching tool, which mainly obtains relevant data through the simulation of experimental objects, and then analyzes them. Analyzing from the broad teaching design, virtual simulation technology is based on a virtual integration experience of the teaching process, combining professional skills with virtual technology and virtual scenes, and finally showing them through people's vision, making students feel interesting and real, and continuously improving students' learning initiative and professional skills .

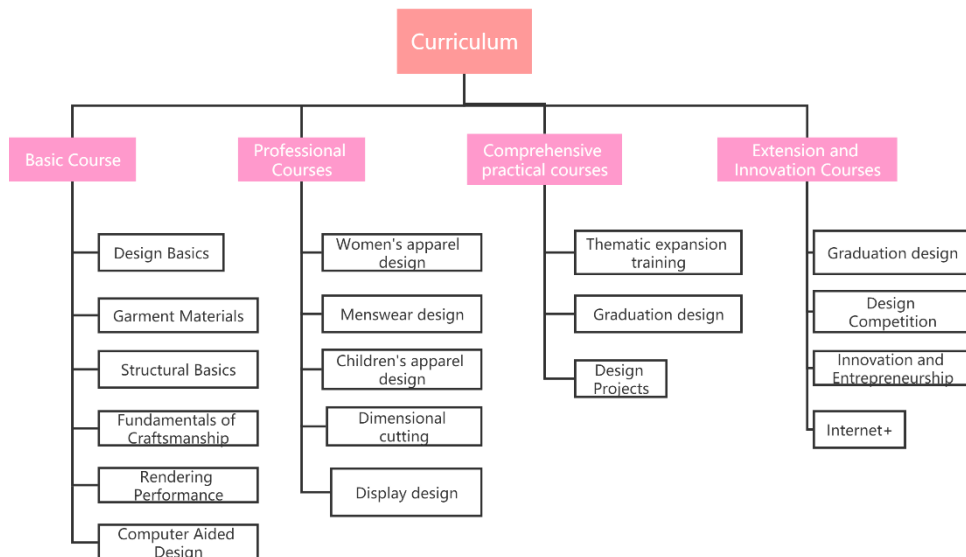


Figure 1. Curriculum

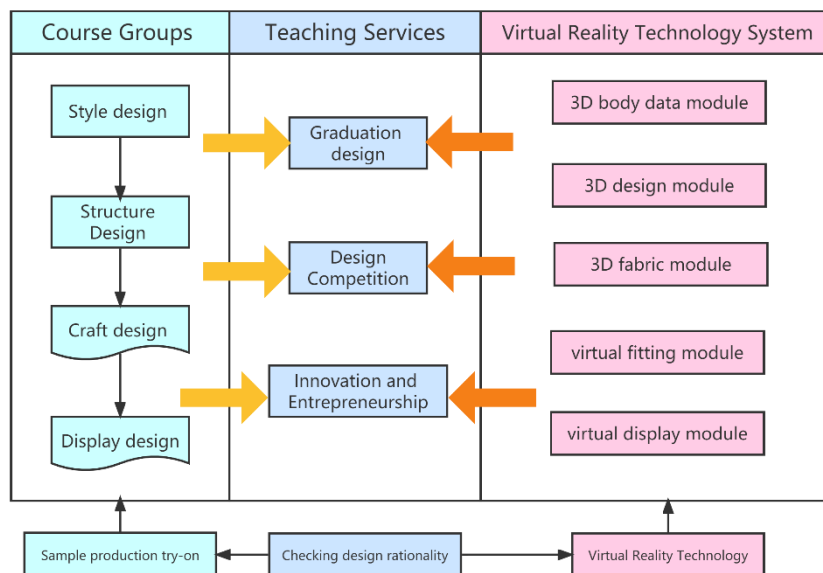


Figure 2. Course System Design

**DISCUSSION**

1. Based on ability cultivation and integration of practical training course content. At present, through continuous teaching reform and practice, the training system aiming at cultivating comprehensive design talents with certain design ability, pattern-making ability and understanding of technology has been gradually formed in the apparel design and technology majors of sample colleges. According to this cultivation goal, the curriculum is based on "professional basic courses - professional core courses - comprehensive practical training courses - expansion and innovation courses" progressive curriculum system, combined with the four parts of the curriculum of design, structure, process and display of the garment profession, as well as comprehensive practical training courses to integrate the content of practical training courses.
2. Improve the practical training content and integrate virtual reality technology. With the continuous development of virtual reality technology, various virtual simulation technology platforms have been perfected in function and are widely used in various fields of the apparel industry. The virtual simulation training room is built on campus, which contains an

integrated design simulation system with 3D body data module, 3D design module, 3D fabric module, virtual fitting module and virtual display module, which can realize the functions of garment profession from design, pattern making, production, sample dress fitting and dynamic display, completely covering the four major contents of garment teaching - -style design, structure design, process production and ready-to-wear display (Zhang, J, 2020 ). According to the course teaching objectives of apparel majors, the practical teaching hours are reasonably arranged, requiring a reasonable ratio of theory and practice, and the content reflects feasibility and necessity, and can be connected with the previous and following courses and improve the course content. In the process of comprehensive practical training, the project teaching method is used to integrate the contents of each practical training module.

3. The cost of teaching expenses investment is reduced. In the practical training practice, the application of virtual reality technology can simulate the creation of realistic working environment, intuitive operation process, historical costume pavilion, display showroom, as well as 3D simulation fabric selection, 3D sample garment trial production, etc.. Compared with the previous teaching faculty, equipment and venue requirements of the apparel design profession, such an approach can effectively reduce the financial investment in teaching and improve the efficiency and skill level of students' practical training.
4. Teaching form innovation. The use of virtual reality technology in the teaching of apparel is a new form of teaching that adapts to the development of information technology and the goal of training applied talents. Virtual reality technology is immersive, interactive and experiential, which can make teaching methods more vivid and intuitive, teaching contents more innovative and assessment methods more mobile and flexible (Wang Y, 2020 ). By using virtual reality technology, teachers can help students understand the abstract theoretical knowledge of clothing, establish the thinking basis of three-dimensional space composition of clothing, and let students experience the spatial relationship between human body and clothing modeling more intuitively; introduce the latest industry information technology to meet the needs of professional digital transformation, which is more conducive to cultivating students' learning interests and abilities (Benjy Marks & Jacqueline Thomas, 2022).
5. Teaching content innovation. In the teaching of virtual reality design, the actual work design and production cases are carried through the whole teaching content, according to the employment group of enterprise positions, driven by the real project tasks of enterprises, oriented by the actual system of students' creation and design, with the market transformation of teaching achievements as the goal, completing the teaching tasks while completing the project tasks, cultivating students' professional habits in the teaching process, realizing the effective connection between higher vocational education and enterprise job talent demand (Hernandez-de-Menendez & M., Diaz, C. E., etl,2020). In the process of learning, we aim at aligning with the professional job specifications and work standards of enterprises, improving students' comprehensive professional quality and enhancing their employment competitiveness.
6. Teaching practice innovation. Through virtual reality technology design teaching innovation and practice, promote the development of garment industry intelligence, informationization and higher vocational education, provide leadership and talent guarantee for the innovation-driven development of the garment industry, and provide a demonstration role for the curriculum reform of garment vocational education.
7. Teaching system innovation. The reformed apparel practical training course is adjusted to the market and enterprise talent demand, and the content of the apparel practical training course is readjusted to increase the course arrangement of digital intelligent manufacturing practical training and emphasize the cognitive ability training of intelligent manufacturing equipment (Benjy Marks, Jacqueline Thomas, 2022 ). As students are familiar with enterprise informationization, intelligence and other high technology, they can quickly integrate into enterprises after graduation, which not only promotes the development of garment professional construction, but also enhances the overall development of enterprise garment technology and the quality improvement of industrial personnel.

## CONCLUSION AND IMPLICATIONS

- a. From the classical Internet to the mobile Internet, and then to the so-called meta-universe or full true interconnection and 3D interconnection, essentially, all are a kind of iteration and evolution of Internet technology, with an iteration cycle of about 10 to 15 years. Therefore, from 2000, a series of events happened in the so-called classical Internet era, and in 2007, the iPhone was released as the representative, entering the mobile Internet era, after more than a decade of development in full swing, from the perspective of technology, the Internet will definitely enter a new industry, this industry is the so-called meta-universe, which is an objective law of technological development. We firmly believe that a new iteration of the Internet will definitely happen, only that there will be stage differences in the path. Virtual reality technology is a new way of expression, which requires very high arithmetic power and hardware, and the establishment of the content provision tools inside and the content itself is a rather long process. The trend is for the physical world to be completely digitized. Virtual reality technology has actually been very widely used in the industrial field. Especially in the aerospace, military, automotive and other fields, the digital twin has been maturely applied for many years. The apparel industry itself has many pain points, and if the digitalization of physical samples is used to solve some industry pain points, it is very meaningful in itself, which is the starting point of our willingness to do a lot of work and efforts on this matter.
- b. Virtual fashion focuses on both expression and connection. Clothing has now gone beyond the stage of covering the body or keeping warm, clothing itself has become a carrier of an individual's inner expression, an externalization of individual humanistic spirit. From this perspective, virtual clothing is in a virtual space, with less constraints and more experimentation. In the future, in this digital world, we may also try different expressions of individuality.
- c. Digital transformation and upgrading is the transformation path of the vast majority of traditional enterprises, but not the only path. Traditional clothing business change, is a digital and offline physical processes in parallel a process, the two are not a mutual replacement, but the process of mutual penetration, superposition and addition. Each enterprise has its own digital resources, and this digital resource can be precipitated and can be edited and used repeatedly, thus improving the efficiency of business operations. From this perspective, any enterprise is actually in a process of improving efficiency, and digitalization is an inevitable process. For apparel companies, apparel style is the most important content, how to efficiently generate style, and let the style in the industry chain of high-speed flow, this is always the industry to solve things. For example, in the physical world, if the factory and the brand are located in different countries, the fabric needs to be mailed from the fabric factory, and after the sample is produced, it needs to cross the ocean. After digitization, the digital fabric is used to generate the digital sample directly, and then a link or QR code is passed to the brand. Therefore, we are greatly improving efficiency in the process of information interaction and communication between each individual flowing link. For example, there are 5 round trips from the designer to the pattern maker to type the sample clothes, and with the digital sample clothes, 2 or 3 round trips may be enough. For example, clothing designers, if they can well harness the virtual technology tools, the future may be a day to design 50 or even 100 styles, while traditional designers design 1 to 2 a day. When designers can be quickly and efficiently stimulated creativity, and the new models can interact with consumers to meet their needs, coupled with the back-end supply chain can be quickly produced, such clothing companies are the real mastery of consumer demand, in order to grasp the first opportunity to achieve a bend over the car.
- d. Higher vocational education must serve the development of the enterprise industry. Virtual reality technology has brought radical changes to apparel design teaching, enabling teachers and students to complete their teaching tasks and plans in a vivid and harmonious environment. Professional teachers are no longer confined to teaching with a single hand-drawn expression. With the help of computers, a complete series of processes such as design, pattern making, sample making and sample adjustment are realistically and quickly simulated, greatly improving learning efficiency and teaching effectiveness. It can release



designers' creativity, and when the tools become easier and easier, the design itself is very valuable. The popularization and application of virtual reality technology in apparel design teaching has freed traditional apparel design teaching from the limitations of traditional teaching and realized the transition from 3D models to real products. Instead of showing apparel design solutions to students through real production objects, teachers can directly use virtual reality technology to present design results in a realistic way, which can improve teaching quality and truly cultivate talents needed by enterprises in the digital transformation context.

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