

# *Design and Implementation of Immersive Virtual Interactive Teaching Courseware Based on VMaker Development*

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**Abstract:** This teaching courseware utilizes virtual reality combined with actual scenario teaching methods to allow students to immerse themselves in a virtual optical instrument assembly training laboratory to learn about the assembly and calibration of single-lens reflex cameras. Based on the characteristics of the course, the industry-leading VMaker editor is used to develop self-made VR courseware that provides live demonstrations of model operation procedures within 3D scenes to complement the lecture content. By using VR teaching methods, traditional PPT presentations and interactive 3D spatial models can be placed on the same screen, allowing for immersive, interactive, and self-guided learning. By wearing a headset and rotating the perspective, students can simultaneously learn theoretical knowledge while observing 3D animations. The combination of traditional teaching methods and new teaching techniques greatly stimulates students' desire for knowledge.

## **1. Introduction**

Under the current rapid development of "Internet + Education", virtual reality technology is constantly evolving, closely integrating information technology and teaching activities, and strengthening the level of information construction in colleges and universities. This promotes the development of high-level practice and training of different types and enables VR technology to occupy an extremely important position in the development and production of multimedia courseware. Courseware is the key carrier for teaching activities. The content of traditional teaching courseware is mainly demonstrated through text, images, and tables, which can achieve good teaching demonstration results. However, it has some shortcomings such as lack of intuitiveness and vividness. With the diversity of multimedia courseware tools, the emergence of animation videos has also played a certain role in creating vividness. Nevertheless, the immersive and interactive learning experience still requires the application and development of VR technology to transform students' perception of things from sensory to rational.

The immersive virtual interactive teaching courseware developed in this study is based on Virtual Reality (VR) technology using VMaker - a virtual reality content production editor. The software has a simple and easy-to-use operating interface and can import traditional PPT into a 3D space. The software enables the combination of 2D PPT with 3D operating scenes, creating a 3D visual, auditory,

and tactile experience of a real environment. It highlights the perceptual, immersive, and interactive features of virtual reality, solves the problem of switching between teaching interfaces and virtual training demonstration operating interfaces in the process of integrating virtual and real curriculum teaching [1], enabling students to be fully immersed in the learning environment. The software can transform abstract knowledge into concrete images, animations, 3D immersive scenes, and interactive experiences. This realization provides a comprehensive, integrated, and holistic approach to teaching, practice training, and assessment. The content editor has basic tool editing functions and can import various forms of materials, special effects, etc. For example, it can be used to develop immersive virtual interactive teaching courseware for the assembly of camera lenses in single-lens reflex cameras.

## 2. Overall Design of Immersive Virtual Interactive Teaching Courseware

The implementation of immersive virtual interactive teaching courseware mainly involves the production of materials libraries, the construction of the Unity3D platform, the creation of VRPPT, the publishing of VCW courseware, and importing these courseware materials. The production of material libraries mainly focuses on the abstract knowledge and skills involved in teaching PPT courseware, making visualized materials that are easy for students to learn, understand, accept, and have interactive information. These visualized materials may include 3D models, images, audio and video, panoramic images, panoramic videos, scene models, APK, etc. The Unity3D platform is used to place traditional PPT in a 3D scene, use dynamic curtains to load traditional PPT courseware, and use handheld controllers to flip through the PPT slides to achieve the synchronization of traditional 2D PPT with 3D model scenarios in the same visual range. The materials are imported into the material library list according to their classification, and “.VCW” format courseware is published, which is then copied to the corresponding folder of the headset, and the VRPPT courseware can be viewed by wearing the headset. The design and implementation flowchart of the immersive virtual interactive teaching courseware based on VMaker is shown in Figure 1 [2-4].

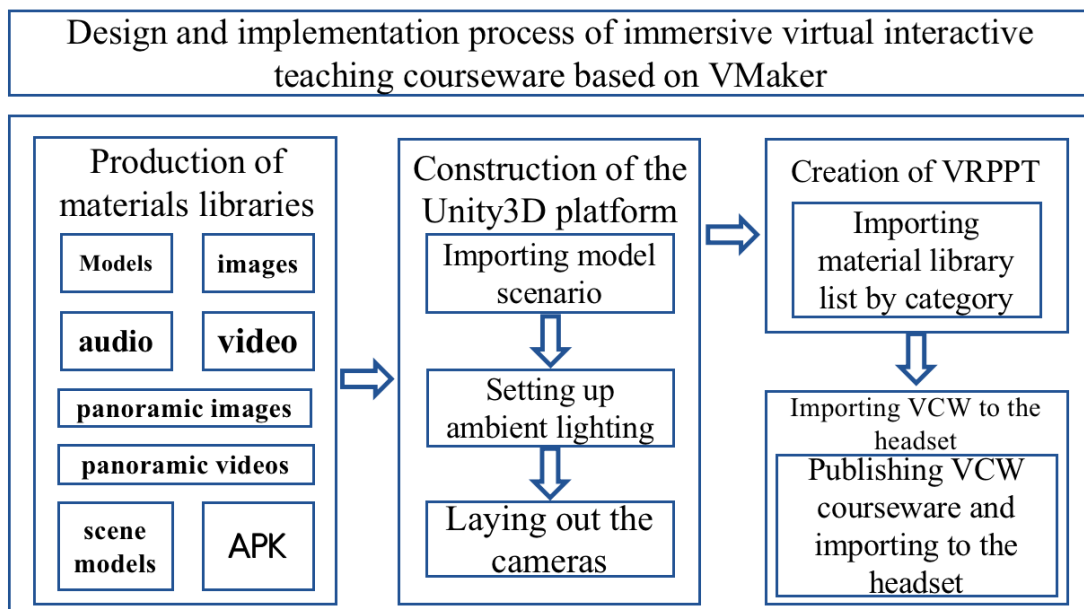


Figure 1: Flow chart of designing and implementing immersive virtual interactive teaching courseware based on VMaker.

### 3. Production of Materials Libraries

#### 3.1. Creating a 3D Model

The UG modeling software is used to create the parts of the single-lens reflex camera lens group model in a 1:1 ratio. Then, the parts models are imported into the 3Dmax software for texturing and baking operations, in order to improve the material and realistic sense of the mechanical parts, and to restore the parts of the lens group as realistically as possible [5-6]. The digital lens group parts of the single-lens reflex camera include: a lens group, b fixed outer frame, c zoom mechanism, d zoom ring, e objective lens, f eyepiece, g bayonet, h eyepiece retaining ring. The specific model is shown in Figure 2.

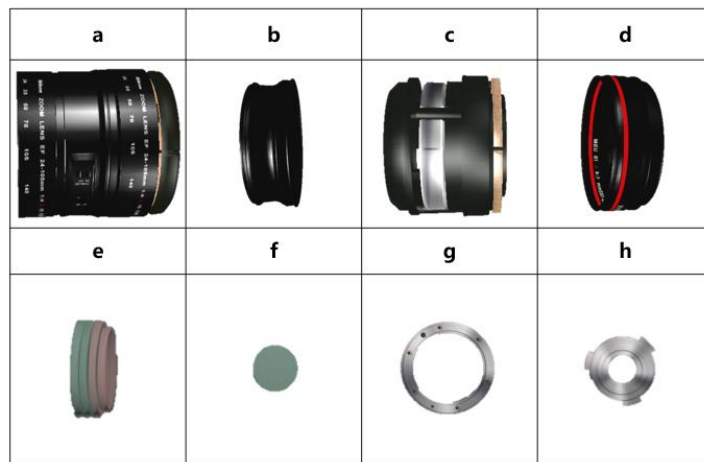


Figure 2: 3D model of the parts of a single-lens reflex camera lens group.

#### 3.2. Production of Other Materials

For learning the knowledge and skills of assembling a single-lens reflex camera lens group, the focus is more on the cultivation and training of assembly operation skills, and guidance is provided as necessary. Therefore, in the production of the material library, in addition to the production of parts models, audio, video, and scene models are all indispensable. “.MP3” format audio is supported; “.jpg” and “.png” format images are supported, with a size not exceeding 8k; “.mp4” format videos are supported, with a frame rate not lower than 25 frames/second, a bit rate not exceeding 30000kbps, and a resolution not exceeding 4k. The Unity3D platform is used, supporting packaging of “.zip” packaging models generated by Unity3D, and separate packaging of scene models and parts production. Background materials support third-party APK, background images, audio, props models, and scene models.

### 4. Creation of Virtual Interactive Teaching Courseware

In constructing virtual interactive teaching courseware using the VMaker software, designers should first create a new project and then proceed by importing “.pptx” file formats through the “Import PPT” function, found under the “File” menu. Importantly, any traditional PowerPoints with affiliated video files cannot be uploaded. Once initiated, the material library, accessible via the toolbar, will enable the systematic categorization and importation of relevant course materials, such as imported related materials. Designers should take care to differentiate the distinct importation processes of the scene models and prop models. Finally, the VRPPT can be distributed by uploading local images or capturing selective segments of the original PPT as a cover. The resultant format of

the published VRPPT is “.vcw” [7, 8]. Such VRPPTs, capable of virtual interactive teaching in the assembling of single-lens reflex camera lens groups and the entire camera setup, are exemplified in Figure 3.

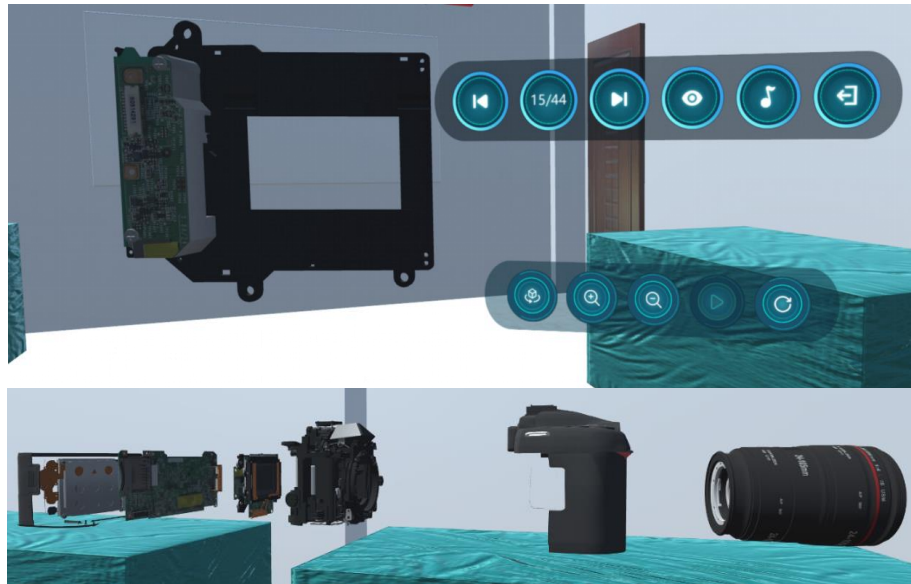


Figure 3: VRPPT renderings of lens group of SLR camera and whole machine assembly.

## 5. Implementation of Immersive VRPPT Features

The implementation of immersive virtual reality simulation technology is based on the principle of stereoscopic projection, as well as virtual reality interaction devices such as headset displays and hand-held motion capture devices. Utilizing a stereoscopic display system, 3D scenes are presented in a mode featuring depth-of-field, creating a highly immersive and natural interactive virtual environment for learners. The environment surrounds the entire visual field and immerses the user in a fully realized virtual world. With the rapid development of immersive virtual reality simulation technology, numerous consumer-grade virtual reality hardware devices have emerged, such as the Oculus Rift VR headset produced by Facebook in the United States, the HTC Vive VR headset by HTC, and the HTC Focus headset, which is the immersive virtual reality interaction device used by VMaker [9-11].

The implementation of immersive functionality involves the deployment of the compressed “.vcw” package to a specified folder on the VR headset. Initially, a physical link must be established between the PC and HTC Focus, facilitated through a data cable. Relying on this connection, mobile assistant software must be deployed on the PC and VExplore subsequently transferred to the “File Management” SD card. With the Focus in place, an engagement with the content library becomes necessary, where a user installs VExplore and proceeds to transfer the packaged “.vcw” file to the VCWCourseware folder before commencing immersive explorations of virtual single-lens reflex camera lens group assembly knowledge. In this context, flipping through VRPPT pages and playing animations using the hand-held motion capture device augments the user’s engagement, with triggers capable of initiating model animations of the assembly process affording an enhanced level of interaction.

## 6. Conclusions

The immersive virtual interactive educational courseware represents a perfect marriage of

traditional 2D PPT and 3D animations, epitomizing an advanced fusion of instructional methodologies. In addition, using the VMaker software, a multi-media approach is adopted to create a vivid and immersive teaching and learning environment. Students and teachers alike are transported to an interactive space, experiencing an active immersion through body action, inhabiting the virtual landscape and engaging in a highly responsive and interactive dialogue with the virtual environment. By shaking off their passive role, students can more effectively acquire knowledge and improve their skills and ability set. However, the VRPPT courseware, despite its advantages, confronts numerous limitations that must be addressed through continued refinement, particularly in complicating the pairing of props and models, and refining models of the virtual environment to meet the needs of immersive virtual interactive education.

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