



Special Section on SIGGRAPH Asia Symposium on Education

# New approach to camerawork skills education for 3D/S3D computer graphics animation

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## ARTICLE INFO

## Article history:

Received 25 February 2016

Received in revised form

5 July 2016

Accepted 12 July 2016

Available online 26 July 2016

## Keywords:

Camerawork

Computer graphics

Educational material

Educational outcome

Skills-based

Stereoscopic 3D

## ABSTRACT

Many vocational schools and universities offer lectures on non-stereoscopic 3D computer graphics (3DCG) animation production, as well as practical 3DCG software operation, modeling, and animation production. However, relatively few of these educational institutions provide lectures on stereoscopic 3D (S3D). To address this gap, we developed two 15-week syllabuses with educational materials, which focused on both knowledge-based and skills-based education about 3DCG animation and S3D computer graphics (S3DCG) animation production, considering the potential employment of students in animation studios. Our investigation confirmed that the knowledge and skills of the subjects improved in this study, so we presented a report on the effectiveness of the educational materials for S3DCG animation production education at the Education Symposium of SIGGRAPH Asia 2015.

By developing these educational materials, we reaffirmed the importance of camerawork skills education, which may be regarded as the cornerstone of 3DCG animation and S3DCG animation production. However, camerawork skills education in 3DCG animation classes remains limited in vocational schools and universities at present. We hypothesized that one of the reasons for the paucity of camerawork skills education is the lack of suitable educational materials for practical classes in the use of 3DCG software. Indeed, educational materials that allow teachers to begin camerawork skills education for 3DCG and S3DCG animation production without preparation are greatly lacking. Furthermore, modeling and character animation are regarded as essential before camerawork practice. Camerawork practice can be started immediately if sufficient educational materials are provided. The educational materials that we developed are suitable for S3DCG but also for 3DCG camerawork practice.

In this study, we present the camerawork skills education and evaluation methods involved in the educational materials developed for the S3D lectures and for camerawork practical classes in S3DCG animation. We then discuss the experimental classes in which we used the educational materials and we report the results of S3D knowledge tests and camerawork practical tests, which were conducted in order to measure the learning/education outcomes for the participating subjects, as well as the results of a survey that focused on their subjective experiences. The experimental results clearly demonstrated improvements in both the knowledge and skills of subjects, thereby confirming the effectiveness of the camerawork educational materials. We suggest that if students with knowledge of S3D and 3DCG animation are well-practiced in the use of these educational materials, their skills in S3DCG camerawork would improve markedly.

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## 1. Introduction

### 1.1. Background

Studios that produce animation for movies, television, and videos recruit students who have received animation education in vocational schools and universities in Japan. However, the knowledge and skills acquired by students at these educational institutions are inadequate

for the actual work required of them. Therefore, they are required to gain the knowledge and skills necessary to work as professionals during on-the-job training after joining a studio.

However, on-the-job training has become more difficult as offshore production has increased. In addition, education in the animation production field has become difficult due to overlap in the switchover to 3D computer graphics (3DCG) from a production method focusing on hand-drawings, as well as to the spread of stereoscopic 3D (S3D) [1]. Thus, it is necessary to improve the knowledge and skills of students before their employment by enhancing the education provided at vocational schools and universities.

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## 1.2. Problems considered

Vocational schools and universities mainly offer lectures on non-stereoscopic 3DCG animation production, as well as practice in 3DCG software operation, modeling, and animation production. However, relatively few of these educational institutions offer lectures on S3D. To address this gap, we developed two 15-week syllabuses (15 classes) with educational materials focused on both knowledge-based and skills-based education in the performance of 3DCG animation and S3D computer graphics (S3DCG) animation production considering the potential employment of students in animation studios.<sup>1</sup> The content of the knowledge-based educational component is listed in [Table 1](#) and that of the skills-based education component in [Table 2](#). Our investigation confirmed that the necessary knowledge and skills were improved for the subjects involved in this study, so we presented a report on the effectiveness of the educational materials for S3DCG animation production education at the Education Symposium of SIGGRAPH Asia 2015 [\[2\]](#).

By developing these educational materials, we reaffirmed the importance of camerawork skills education, which may be regarded as the cornerstone of 3DCG animation and S3DCG animation production. However, camerawork skills education is very limited at present in 3DCG animation classes provided by vocational schools and universities. We hypothesized that one of the reasons why camerawork skills education might be insufficient is the lack of suitable educational materials for practical classes in the use of 3DCG software. There is a lack of educational materials that can be used by teachers to begin camerawork skills education for 3DCG and S3DCG animation production without preparation. Furthermore, modeling and character animation are regarded as essential before camerawork practice. Camerawork practice can be started immediately if sufficient educational materials are available, such as a consistent set of assets for a sample animation task comprising character models, background models, character animations, textures, lights, etc., as shown in [Fig. 1](#). The educational materials we developed are suitable for S3DCG as well as for 3DCG camerawork practice.

In this study, we begin by describing the camerawork skills education and evaluation methods included in the educational materials developed for S3D lectures and for camerawork practical classes in S3DCG animation. We then discuss the experimental classes where we used the educational materials, as well as report the results of S3D knowledge tests and camerawork practical tests, which were conducted in order to measure the learning/education outcomes of the participating subjects, and the results of a survey that focused on their subjective experiences.

## 1.3. Structure of this study

In [Section 2](#), we describe the purpose of developing the educational materials for camerawork practice, which are relevant to both S3DCG and 3DCG animation production. [Section 3](#) explains the educational materials that we developed for S3D lectures and camerawork practical classes, including the syllabuses, digital textbooks, completed animation work, assets, S3D knowledge test, and camerawork practical test. [Section 4](#) describes the experimental application of the educational materials and the results of this application. Based on the experimental results, in [Section 5](#), we discuss why we propose that the developed educational materials may be beneficial for students and their camerawork skills education, and how they can be used for both 3DCG and S3DCG animation production. In [Section 6](#), we give out conclusions based on the research and we discuss future challenges.

## 2. Purpose of developing the educational materials

### 2.1. Conventional education

Education in 3DCG animation has been offered in the USA and Japan since 1990 [\[3,4\]](#). The findings of a survey that we conducted regarding the content of such courses at 33 vocational schools and 29 universities demonstrated that classes focus mainly on 3DCG modeling and then on 3DCG animation production. Camerawork skills education is covered by parts of the animation classes. However, if the time spent teaching character animation is assumed to be 100 percent, then camerawork is taught for only about 60 percent of the time at universities, and only about 30 percent of the time at vocational schools, where less time is spent on this type of education in Japan [\[5\]](#).

Public descriptions of the animation programs in fine arts universities in the USA are provided on their webpages. For example, the Character Animation Program in the School of Video/Film at the California Institute of the Arts includes education on a variety of topics, with a focus on character development and narrative storytelling. Students are required to have the ability to draw. The program offers classes in traditional (hand-drawn) animation and it allows students to develop their skills in either 2DCG or 3DCG animation, or both, in order to produce professionals who can work with writers and teams. However, this program may not include classes that focus specifically on camerawork [\[6\]](#).

The Ringling College of Computer Animation offers an educational program that focuses on creating characters and telling their stories, as well as designing, painting, modeling, texturing, animating, lighting, composing, and editing original films. This institution aims to produce the leading animated filmmakers of the future. However, it seems that few of the classes focus on camerawork [\[7\]](#).

The Animation Program at the Savannah College of Art and Design offers classes that allow students to learn various methods in 3DCG, including modeling, rigging, texture mapping, lighting, and rendering, as well as production methods by introducing the principles of traditional animation into 3DCG animation. This program aims to develop dynamic and multifaceted animators to enter the industry. However, once again, few classes appear to be focused on camerawork [\[8\]](#).

S3DCG animation education has only begun in recent years and it was included in a course at the annual SIGGRAPH conference during 2010 [\[9\]](#). This course was offered for professionals who had knowledge of the graphics pipeline for animation or real-time applications. The lecturers described how S3DCG animation can be applied to games and real-time applications in terms of standard stereo projection technology, factors related to depth perception and the comfort of viewers, and its use as a storytelling tool. The course was taught in lecture format, and presentations and videos were used as educational materials. Students on this course could acquire knowledge of S3DCG camerawork, but it was not possible for them to learn 3DCG camerawork skills.

An S3D course for movie production was launched at the School of Cinematic Arts at the University of Southern California (USC) in the USA during 2012 [\[10\]](#). This movie production course lasts for 15 weeks and it teaches knowledge about concepts and technologies related to the production of S3D images, mainly through lectures. The skills of students are developed by producing videos of short live-action films. This course also takes advantage of its close proximity to Hollywood by offering guest presentations from S3D video professionals and tours of the shooting facilities in local production houses. This course aims to enable students to utilize S3D in their specialized areas. In terms of educational materials, the course makes use of many commercially available technical books about live action S3D video. This course is a center for S3D knowledge acquisition and live-action

<sup>1</sup> Note that each class comprised 90 min per week.

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