



An Integrated Lecture-based Teaching Strategy via Social Activities and News Express Production

Yu-Chieh Wu

Ming-Chuan University

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Abstract.

Learning modeling 3D while integrating 2D image processing techniques is difficult. The main reason is that the complexity and geometry concept is not very concrete in real world. On the other hand, for communication education, organizing a well-formed news express is also an important lecture topic. Nevertheless, it is known that studying 3D modeling technique is challenging. Most of the communication students have limited prior-knowledge about architectures, 3D concept, and mathematics. Cognition of the 2D and 3D space forms the fundamental basis of the design activities. Many opened courses started from 2D image design/processing and then mentioned the 3D space concept before 3D modeling lectures by follows. News-based illustration is quite common seen in many lectures and administration topics. To engaging studying, in this paper we design a novel lecture administration strategy that combines social activity and project-based learning as to develop news express in presentation. In the social activity, students are required to collect feedback and try to demonstrate to people online. In teaching project goal, learners work together and learn to establish big project as team work. In the final stage, each group should accomplish the news express design within 2 hours and publishing to social Web site. The proposed teaching strategy had been applied in real university course in two years. The empirical result showed that learners not only immersive in doing project, but also substantially improves the 3D modeling capability in course. The result of the satisfactory quiz shows that the teaching strategy is highly positive for learning.

1. Introduction

Learning 3D modeling is still challenging currently though with the rapid growth of deep AI. The main reason is that the complexity and geometry concept is not very concrete in real world. In multimedia art design, the integration of 2D image processing and 3D modeling skills are often considered as the main object for higher educated students. For example, in image processing, learners need performing single photo processing via image authorization tools, such as Adobe photoshop CC. Things behind 3D model design is to examine learners capability between 2D and 3D processing. It is required to realize concept from 2D to 3D. Cognition of the 2D and 3D space is just the basis of the design activities. Hence, many opened courses started from 2D image design/processing and then talk about the 3D space concept before 3D modeling lectures.

Several prior research works had been addressed the use of multimedia technologies as a part of learning materials. The well-known ARCS (attention, relevance, confidence, and satisfaction) model of motivation was formed in response to find more useful ways of understanding the major factors on the motivation to learning (Keller, 1983). ARCS model defines four major conditions (attention, relevance, confidence, and satisfaction) that have to be fulfilled to become and remain motivated (Dick, Carey and Carey, 2001). After applying the multimedia aided learning, learners' attention, should be ideally enhanced and promote learners' confidence and satisfaction in effective way.

Learning in 3D modeling design usually involves in a complex and dynamic process. Students start from something in mind which is not real but abstract. They are required to develop a 3D form through the use of 3D development tools. The main problem faced by students in the design process is that the limited ability of conventional media to generate a good visual presentation of more complex space (Kalisperis and Perhliivanidou, 1998). According to Lawson (1997), the architectural design is a process in which designers create spaces, places, and buildings that have a major impact on the human life. An earlier research study (Moum, 2006) investigated the use of high-tech-based visualization media for digitization of the conceptual architectural design process. Both (Fruchter, 1998) and (Ibrahim, 2007) present a positive effect when integrating design and construction process to support collaboration among team members. In addition, by the use of high-tech-based media, the cost of labour and material production can be greatly reduced.

The introduction of 3D modeling software such as AutoCAD and Sketchup had been applied to be required courses and showed excellent performance over the past decades. Examples includes, space planning (Lydia, 2014), engineering design (Robertson and Radcliffe, 2009), safety for construction industry (Liao and Chiang, 2016). A set of previous studies also addressed the introduction of 3D modeling technique as a part of lecturing tools. In current, the Sketchup received a great attention and is becoming the main 3D architecture developing software in education and industry. To extend the 3D modeling skills, it is required to co-work with the other 2D image processing systems, such as photoshop and CAD. CAD tool can be used as a preprocessing tool in creating the 2D layout images, while the photoshop processing often adds the image special effect when generating 2D images. In the learning process of 3D modeling, SketchUp usually provides direct and clear view for students in space design. It inspired learners' attention

via a simple and easy interface with efficient response and view (Liu and Guo, 2009). Meanwhile, some rendered tools also pluggable to SketchUp in which an even almost-to-real photo images can be generated. Another good property of SketchUp is that it does not only produces precise 3D models, but also sharable with the other 3D modeling software, like MAYA and 3Ds Max. The constructed 3D models can also now be viewed in most smart phone and smart Pad¹.

In this paper, we present a novel teaching strategy that combines social activity (facebook) and project-based learning in learning activity. The social activity gives a strong motivation that activates students to expand the time in self-study, while the project goal enhances the intensity of learning effect. In the social activity, students are required to promote the final product and try to demonstrate to people online. In teaching project goal, learners work together and learn to establish big project as team work. In the final stage, the proposed richman-like gaming competition is taken into place. We had applied the novel teaching approach in real university course. The empirical result showed that learners not only immersive in doing project, but also substantially improves the 3D modeling capability in course. Furthermore, some learners clearly indicated that the teaching method help to be learning much more actively.

2. Three-D Modeling Sketching Tools In Education

For higher education, such as college students, learning 3D modeling is usually treated as part of CAD learning (computer-aid). Tutoring 3D modeling techniques, involves in novel software technologies and fewer hardware supports. For example, the equipment of computer graphic cards and monitors is important but fixed and stable nowadays. However, most software are usually updated monthly or yearly updated with large changes. A set of image and video processing authorization tools is quite common seen in school. It is often the case that basic MS-Office technique (for example, PowerPoint, Excel, and Word) or certified-test should be passed in the first or second year. In the second year, the InDesign and Photoshop techniques are addressed in most design and construction oriented colleges for some countries. For example, in Taiwan, the Powerpoint and Excel lectures are the basic required courses in the first year while the Image processing-related courses are the optional. By means of the basic image processing experiences, learners could pick up the 3D modeling lessons as the main major subjects. However, before participating 3D modeling-related courses, the basic image processing skills are required.

Sketchup is one of the successful 3D modeling softwares that is easy to learn and easy to realize 3D models with exact and precise measurement. Many research studies had proposed to addressed the effect of using sketchup in education (Ibrahim and Rahimian, 2010; Afacan and Demirkan, 2011; Liu and Guo, 2009; Sampaio et al., 2010). Sketchup also is a pluggable software that allows developers append additional functions via script languages. One good property of SketchUp is that it does not only produces precise 3D models, but also sharable with the other 3D modeling software, like MAYA and 3Ds

¹<http://www.sketchup.com/download/gsvviewer.html>

Max. The constructed 3D models can also now be viewed in most smart phone and smart Pad². In this paper, we focus on the learning effects of using the SketchUp as 3D modeling tool in normal lessons.

Creating 3D models in Sketchup generally involves several stages, including the following items.

- Start from two-D image files.
- Retouching and improving 2D images.
- Import to 3D software.
- Define measurements.
- Modeling from 2D.
- Model comparison and refine.
- Arranging.
- Tiling and Material texturing.
- Rendering.

In basic, the Sketchup is not directly support CAD file. When importing the file, the edges are not connected as well as in the AutoCAD. To solve this, preprocessing technique is applied. First, we purge all the unused layers and edges in SketchUP. Then, blocks all layers and merge to single layer. Finally, we lock the newly merged layer as the bottom of the building. Users begin creating the 3D models through the above mentioned steps.

At a University of Taipei, in computer assisted learning program, included in the required courses in college, the skill of 3D modeling, interior design, house creation, 3D photo-match skills have been included as the main agenda goal in lesson. For the case of multimedia design, the most exiting lesson is to modeling the house inside, starting from normal floor plan that produced by the well-known autoCAD software. Figure 1 gives a simple illustration of 3D modeling from normal Google Map (using Trimble SketchUp).

Development of the teaching strategy

In the beginning of 12 weeks of the in-class teaching activity, the normal teaching strategy forms the basis of the main teaching process. The instructor initializes with empty project, and then all learners continue followed. The entire teaching process mostly synchronizes and follows the textbook. The teacher explains each function in the Sketchup and illustrates with empty example. Student can directly use smart phone to record the operation process during teaching and re-do in class or post-class.

²<http://www.sketchup.com/download/gsvviewer.html>



Figure 1: An illustration of 3D modeling from normal 2D floor plan.

3. Compound Teaching Strategy

Our teaching goal is to let the students creating and promoting the designed 3D models. In this course, the main subject is to design a house, including interior and outside infrastructure design. Our proposed compound teaching strategy relies on three main steps: 1) team work and 3D modeling, 2) strong force in social activity, and 3) monopoly-like game process. The first step is merely the implementation of the 3D models with team work. Learners are freely in choosing the group members. To have better quality in this assignment, each group is limited in less than 3 people. After grouping, each team can co-work and discuss the roadmap and then realize the 3D model.

Learners in the second step should login to the social activity platform - Facebook and try to interact with their friends or unseen people who try to access the page. In this step, students must present the created 3D models house on their FB page. Every learner is required to promote the house online as well as putting the commercial ads and starting from their relations. There is no any burst time limitation in this step. But the deadline of closing the FB is one-day before the monopoly game process. Our assumption is that people often demonstrate the goods and beauty in personal pages, while less addressed in uninteresting and boring things. The created 3D models motivate learners in doing even better and better works since they have to show up in public. In this step, the number of response and goods is also a part of evaluation in this course. This strategy further activates students in doing the 3D model. Figure 2 shows an example of the students social activity in Facebook.



Figure 2: An example of the student's social activity in Facebook.

Figure 3 shows the students' works.



Figure 3: Examples of students' work.

The third stage is to invite all learners in joining the monopoly-like game in class. Every student has a limited budget say 20 million bills. Every team needs to define the selling price, ranged from 5 ~ 25 million. Every team needs to define the price before trading time and demonstration time in order to keep the fairness. To motivate trading, the students are encouraged to buy house. The best buyers can get additional credit if the bought house is the most popular product in class.

Before the monopoly game, each team has 5minutes in presenting their work and design. During the presentation, the game players can see the designed 3D models, FB records and logs, and rendered images, and even the prepared videos. Every seller can make use of the five minutes to customers. The demonstration is taking in predefined order which is chosen randomly. After the demonstration, there are 25 minutes for marketing and trading. Each person can visit the others and determine to buy or not. The price is also negotiable in this period. This is used to approach to real. In real-world, the buy and sell is free. Each team needs to collect the buyers name and take the money. In the final stage, the instructor calculated the final results according to the performance of buy and sell. The buyers who own the house which is the most popular in the class

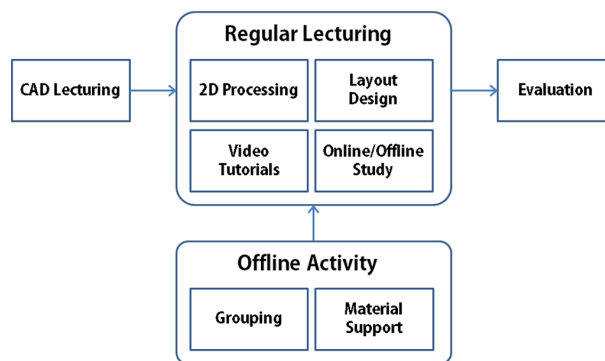


Figure 4: An illustration of the monopoly-like game in 3D modeling course.

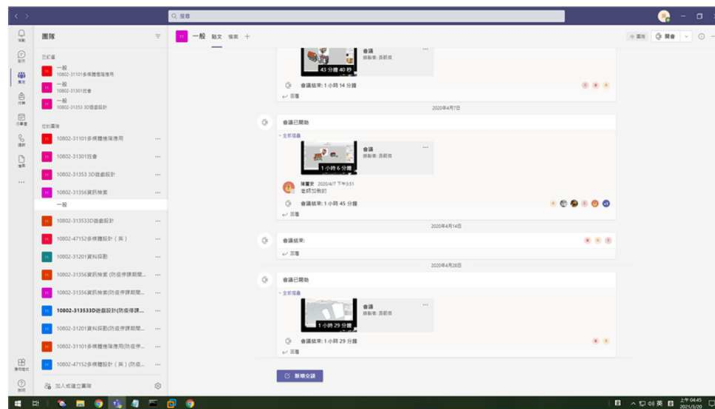


Figure 5: Online lecturing snapshot.

are recognized as good buyers. Alternatively, the team who created the most popular house is also identified as the best sale team. Figure 4 depicted the designed teaching strategy in 3D modeling lectures. Figure 5 shows a snapshot of the online learning in the course.

4. Experiments

We apply our method to real courses in the opened courses of university. Testing subjects come from two sources: college of communication which includes communication department, dept. of radio and TV, dept. of advertising, dept. of journalism, etc. in Taiwan and the second students come from international computer science (CS) program students. Both courses were opened in the third-year in the university and hence the age were all ranged from 21~24. The course opened in communication-related departments was the option course in the college. Students who participated the course have various backgrounds in 3D design. All of them were fresh in 3D modeling and interior design. In this course the instructor can use their mother-language during tutoring. Since the course is the required course in the CS program, all the students who majored the course were come from the same department. In this course, the teacher needs to speak English because of the students were not local-student. Table 1 summarizes the statistics of the testing subjects.

Table 1: The statistics of the testing subjects.

	Course Name	Female	Male	# of subjects
105 News Journ.	3D Design (option course)	23	25	48
105 New Media	3D Design (required course)	30	35	65
106 Ads and Marketing	3D Design (option course)	52	32	84

The experimental flow can be found in Figure 6. In the beginning stage, a pre-test is taken place in order to examine the initial differences between groups. The testing question includes the basic interior design in the textbook. Given an empty AutoCAD file and image, each learner needs to create the corresponding 3D models, while fill the requirements, such as 3 rooms, 2 toilets, 1 kitchen, and 1 living room. The two classes were evaluated with the same pretest questions. The test took 2 weeks. After the due day, the instructor evaluates the outcome for each student according to the model shape, geometry color, measurement, rationales, space usability, and completeness.

In the second stage of the experiment, teacher needs to explain the rules and goals of the project. In the following 4 weeks, the lecture is no change, i.e. teacher demonstrates how to create specific 3D models, design complex components, and how rendering tool is used. After formal learning, it is free for learners study and co-work offline. Each group

could call meeting and discuss their group project. At this stage, some students start put a little outcome on Facebook in order to earn more times in social activities.

Next step is the presentation day. As mentioned before, each group needs to demonstrate the designed house and play the monopoly-like game. Figure 7 shows the students demonstration show. At this stage, each group showed their product on the screen, while simultaneously transmit the same screen to the other students in class. In the end of the game, students are required to evaluate the 3D modeling capability with the same questions tested in pre-test. As pre-test, the instructor should evaluate the basic 3D model creation capability with the same evaluation metrics- model shape, geometry color, measurement, rationales, space usability, and completeness.

5. Results

Figure shows the real trading time in the class. Students can negotiate price and house spec in this stage. It is observed that some teams have never change the price in selling stage, while the remaining (70) the paired t-test between the pre-test and post-test result. We also perform significant test before applying the proposed teaching strategy.

Column 2 and column 3 in Table 2 represent the communication college students and international computer science students, respectively. Before applying our teaching strategy in learning, the pre-test score in average is about 77~79. We also evaluate the statistical significance between the two groups (105 New Media and 106 New Media in the same department) with pre-test scores. The t-test result is $p = 0.102$ which means there is no significant difference between the groups in the initial stage. After applying our teaching strategy, the paired t-test result indicated that the p-value is far lower than

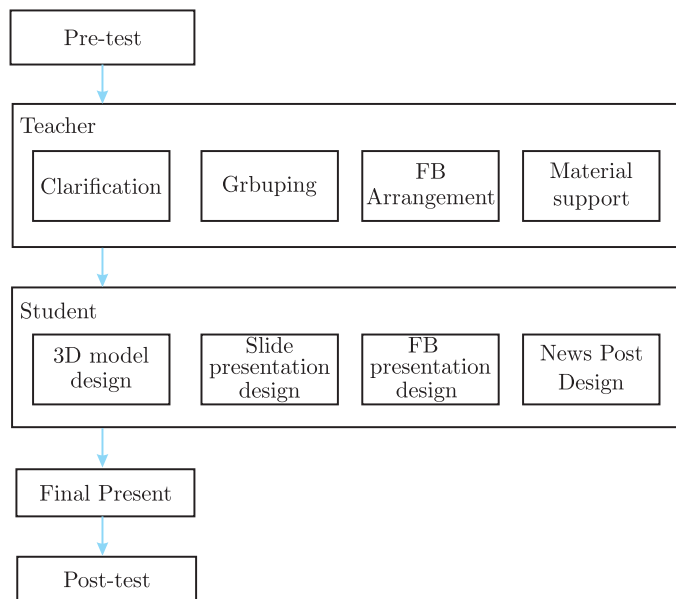


Figure 6: Experiment flow of the designed teaching strategy.



Figure 7: Photos of the demonstration time for each team.

Table 2: Paired t-test between pre-test and post-test.

Paired t-test	105 New Pre-test	Media Post-test	106 New Pre-test	Media Post-test
Mean	77.15	85.63	79.96	86.96
Variance	72.08	11.2	87.39	19.96
Subjects	57	57	25	25
Pearson correlation coefficient	0.52		0.29	
t statistics	-8.75		-3.85	
$p(T_j=t)$ one-sided	$\ll 0.001$		$\ll 0.001$	
Threshold (one-sided)	1.67		1.71	
$p(T_j=t)$ two-side	0		0	
Threshold (two-sided)	2		2.06	

0.001 in one-sided. As shown in Table 2, the mean value in post-test in Comm. college is 85.63 which outperforms the pre-test score (77.15). According to the one sided paired t-test result, our teaching strategy statistically significantly improves the student learning effect.

Figure 8 provides another significant test between the pre-test and post-test results. The p-value for international CS students is 0.0014 which is also significant, while in the communication college the p-value is much lower than 0.0001. Consequently, both statistical testing methods agree that our teaching strategy significantly enhance the student learning in 3D modeling. We also apply t-test to evaluate the significance between the two groups in post-test performance. The p-value is 0.1 which means the result is no difference between the two groups after applying our teaching strategy. Figure 8

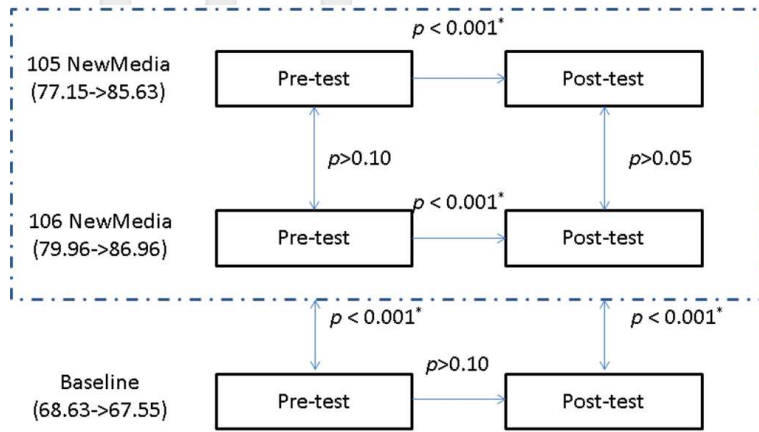


Figure 8: Significant test between before and after applying the teaching strategy in testing groups.

illustrates the significant test results.

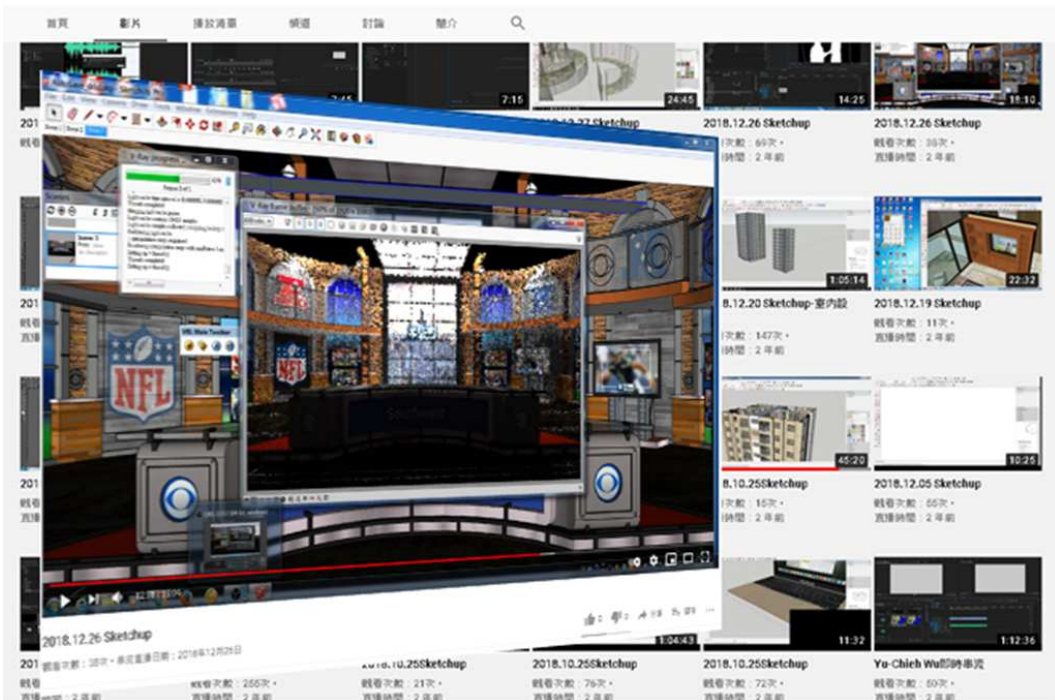


Figure 9: An illustration of the online lecturing list.

Figure 9 shows the list of the online-supported video tutorial materials (<https://www.youtube.com/channel/UC69UQCTOdUmDQXAPKqjyStw/videos>). In the list, we provide not only the video lecture for the subject, but also similar lectures which mentioned how to publish news and image/photo retouching techniques. For advanced

learners, they could pick up the tutorials which cover video processing as supplement materials to enhance their final production. The Facebook marketing phase activated them in doing better 3D model design. The monopoly game provides the platform that allows each team showing the constructed products. In the trading time, they enjoy interacting with the others in class which is also interesting and exciting. Table 3 lists the returned teaching satisfactory questionnaire. There were 5 items in the questionnaire, course design, practice, class control, teaching evaluation, and teaching assistance. Clearly, the designed teaching strategy shows highly agreements for the five items (all of them > 4).

Table 3: Results of the Satisfactory questionnaire..

Items	Result (at most 5)
A1. Course Design	4.26
A2. Practice	4.39
A3. Class Control	4.35
A4. Teaching Evaluation	4.35
A5. Teaching Assistance	4.38

6. Conclusion

Computer-aided learning is one of the most important courses in higher education. This paper presents a new teaching strategy that enhances the learning motivations, self-learning ability, attitude, and team work effect. Our method involves in three steps: 3D modeling implementation, Facebook promotion and interaction, and the monopoly-like gaming process. We had applied the strategy in two classes in which students have various backgrounds. The experiment time is 5 weeks in total. The empirical result showed that learners not only immersive in doing their project, but also substantially improves the 3D modeling capability in course. Two statistical significant tests both agree that the designed teaching strategy significantly improved than before. The full lecture materials and information announcement is shown in the web site . The site also includes the real video stream and photos that demonstrates the learners modeling outcomes.

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New Media and Communications, Ming-Chuan University, Taiwan, ROC.

E-mail: wuyc@mail.mcu.edu.tw

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