

Development of a Lesson Plan Utilizing Projection Mapping for a World of Computer Graphics Course at Hiroshima Jogakuin University

Rieko NISHIGUCHI*

(2022年11月30日 受理)

Keywords: World of Computer Graphics CGの世界, Projection Mapping プロジェクションマッピング,
Tsutaeru Chikara (“Skills of Finding One’s Voice”) 伝える力

1. Introduction

Recently, Hiroshima Jogakuin University has been educating students to help them foster skills in relation to “finding one’s voice” (*tsutaeru chikara*). In an earlier study, the author¹⁾ reported the effects of fostering *tsutaeru chikara* in Computer Literacy (a compulsory first-year course).

Projection mapping, in which images are projected on buildings, castles, etc., is being seen increasingly frequently at events, either on the spot or online, and is extremely engaging since the images change in very dramatic ways. Some researchers have adopted projection mapping as an educational tool. Kotani and Kotani²⁾ compared images from projection mapping with those on a computer monitor in terms of valuation methods in visual art lessons. Oie et al.³⁾ studied projection mapping launched as a student-run project and suggested incorporating it into students’ daily lives as a new mode of expression. Equally, Yoshikawa⁴⁾ reported that in a student-run project, some students combined their expertise to achieve large-scale projection mapping with a message.

In the present study, a lesson plan was developed for the World of Computer Graphics course (a second-year elective course) using projection mapping that aimed to stimulate feelings of curiosity, interest, and enthusiasm. Then, a

questionnaire survey regarding the projection mapping was conducted on the students, and the effectiveness in fostering *tsutaeru chikara* was compared with that reported in a previous study¹⁾.

2. Lesson Plan Outline

The World of Computer Graphics course is offered to second-year students studying in the field of Life Production at the Department of Life Design in the Faculty of Human Life Studies. First, students learned about the projection mapping system. Then, in the 45th minute of the first of two lessons, they viewed a projection mapping project conveying an encouraging message (“Light of Hope”) performed at Huis Ten Bosch^{F1)} in Nagasaki in August 2020 via YouTube^{F2)}. Then, in the 45th minute of the second lesson, they created a simple projection mapping project in virtual space using Mori’s method in PowerPoint^{F3)}. A cardboard box (Figure 1) purchased



Figure 1. Cardboard box as the projection surface

* 広島女学院大学人文学部人間生活学部共通教育部門教授

F1) Huis Ten Bosch is the largest theme park in Nagasaki, Japan. <https://www.huistenbosch.co.jp/> (last visited Nov. 12, 2022)

F2) <https://www.youtube.com/watch?v=B8PGYykITkQ> (last visited 12 Nov 2022)

F3) <https://foreststaroswaldbog.hatenablog.com/entry/2019/01/01/171933> (last visited 5 Sep 2022). The method was based on YouTube videos (<https://youtu.be/2hq74ZvhqO4> and <https://youtu.be/ECyTNqK7uXE>) (last visited Sep. 5, 2022)

through an online shopping site was prepared as the projection surface.

The procedure for creating the projection mapping in the lesson was as follows:

1. Download an image of a cardboard box.
2. Open the image in PowerPoint.
3. Trace the edges and create animated effects (Figure 2(a)).
4. Fill the faces with different colors and create animated effects (Figure 2(b)).
5. Draw a star on a face and create animated effects (Figure 2(c)).
6. Draw a moon on a face and create animated effects (Figure 2(d)).
7. Adjust the duration of the animated effects.
8. Export the PowerPoint data as a video file in MPEG format.

As an advanced application, students watched a video created by the author (Figure 3) in which cherry blossoms moved along the cardboard box and gathered on the top face.



Figure 3. Final scene of the projection mapping project entitled “Cherry Blossom Dance”

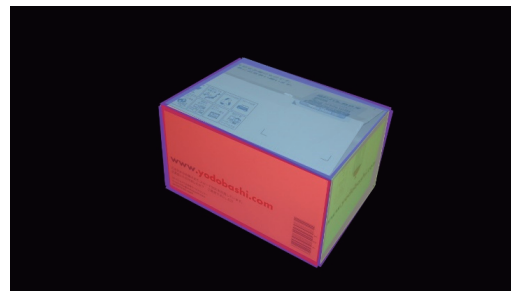
3. Results and Discussion

The students were required to make remarks on the projection mapping at Huis Ten Bosch, which were then shared in Google Classroom. They seemingly took interest in the skills required for projection mapping as well as the computer graphics projected onto the building.

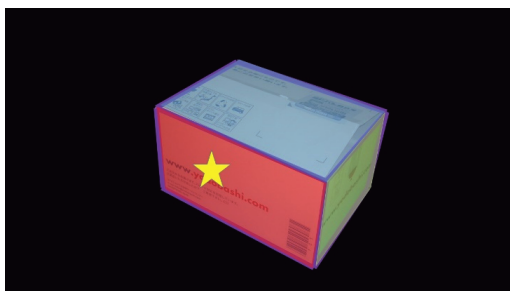
A five-item questionnaire survey regarding the projection mapping assignment was submitted to the students using Google Forms. The students were required to answer the items on a five-point scale. The results are shown in Table 1, along with the obtained data from the earlier study



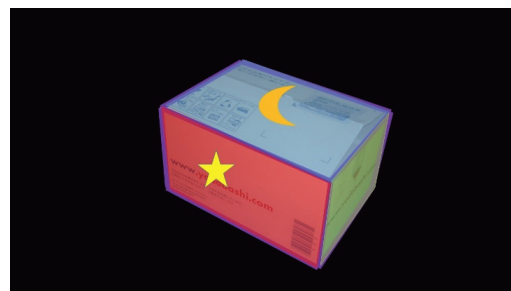
(a)



(b)



(c)



(d)

Figure 2. Procedure for creating a projection mapping project.

(a) The edges are traced and animated effects are created. (b) The faces are filled with different colors and animated effects are created. (c) A star is drawn on a face and animated effects are created. (d) A moon is drawn on a face and animated effects are created.

Table 1. Comparison between the average levels for the four assignments, (a) to (d), in Computer Literacy I and that of the projection mapping assignment in the World of Computer Graphics course.

	(a) Flower shop	(b) Hana pay	(c) Smart speaker	(d) 500-yen coins	Average level of (a)–(d)	Projection mapping
Curiosity	4.11	3.76	3.59	3.84	3.82	4.22
Interest	4.14	3.72	3.72	3.94	3.88	4.15
Difficulty	3.46	3.62	3.69	3.52	3.57	3.59
Enthusiasm	4.18	3.90	3.62	3.65	3.84	3.96
<i>Tsutaeru chikara</i>	3.89	3.69	3.83	3.74	3.79	3.67

regarding four different assignments in Computer Literacy.

The average level of perceived difficulty (3.59) for the projection mapping was similar to those of the other four assignments. The average levels of both curiosity (4.22) and interest (4.15) in projection mapping were the highest among the five assignments. However, the average level of enthusiasm (3.96) was lower than that for the flower shop assignment (4.18).

In a previous study, the author described that placing students in a challenging situation helped foster *tsutaeru chikara*. For the flower shop assignment, the students were given only minimal information. However, for the projection mapping assignment, the students had to follow prearranged procedures under time constraints. Accordingly, the average level of enthusiasm was seemingly low, which presumably led to the lowest level of *tsutaeru chikara* (3.67) observed among the five assignments.

In free responses, some students in the World of Computer Graphics course in 2021 wrote that they acquired unexpected skills using PowerPoint and that they wanted to create an original projection mapping project. Considering the average levels of curiosity (4.22) and interest (4.15) in the projection mapping, a challenging assignment with topics interesting to students could be expected to foster their *tsutaeru chikara*. However, a 45-minute lesson is not enough time to create an original projection mapping project, so the possibility of having students collaborate in creating such projects during university events (e.g., Open Campus, Halloween, campus festivals) needs to be considered.

4. Summary

Here, the author introduced projection mapping in virtual space using PowerPoint in the World of Computer Graphics course. In the present study, students were curious about projection mapping and expressed interest in creating an original projection mapping project. However, the average level of *tsutaeru chikara* in projection mapping was the lowest among the five assignments.

In the 45-minute lesson, students did not have sufficient time to create an original projection mapping project. Therefore, collaboration with university events might be needed to foster *tsutaeru chikara* in students.

References

- 1) Rieko NISHIGUCHI, Information literacy education aimed at fostering 'tsutaeru chikara' (skills for "finding one's voice") at Hiroshima Jogakuin University, Journal of the Faculty of Human Life Studies, Vol. 9, pp. 81–91, 2022. <http://harp.lib.hiroshima-u.ac.jp/hju/metadata/12392>
- 2) Akio KOTANI and Mao KOTANI, A study on using a projection-mapping system for design education, Japan Journal of Educational Technology, Vol. 40, Issue Suppl. pp. 125–128, 2017. <https://doi.org/10.15077/jjet.S40069>
- 3) Yuichi OIE, Yuka IKEMOTO, and Tomoyoshi YOSHIDA, Projection mapping in a student project -A practice report and suggestions of new expression methods-, Proceedings of the 23rd Japan Information-Culturology Society Conference, pp. 84–86, 2015.
- 4) Ryo YOSHIKAWA, Report on the activities of student-run projects (Part 5): Projection mapping project, Journal of Nagoya Bunri University, Vol. 22, pp. 33–38, 2022.

〔研究ノート〕

広島女学院大学における「CGの世界」での プロジェクションマッピングを使った授業展開

西 口 理恵子 *

要 旨

広島女学院大学で科目「CGの世界」においてプロジェクションマッピングの手法を使い、バーチャル空間で箱の画像にマッピングを行ない、本学の伝える力に対しての学生の評価をアンケートにより検証した。作成に先立ちハウステンボスで実際に行われたプロジェクションマッピングをYouTubeで視聴しGoogle Classroomで学生間で共有し意見交換の場とした。プロジェクションマッピングの実習では、45分という時間的制約のためパワーポイントを使った。

以前の研究で行った「情報リテラシー」の結果との比較をした。好奇心、興味度、熱中度の平均値は今回のプロジェクションマッピングの方が高かったが、伝える力に関しては、「情報リテラシー」の花屋の課題よりは低かった。これは、45分という時間内で決められたものを作成したため学生のオリジナルな作品にはなかった点が原因として考えられる。他大学で行われている学生プロジェクト形式による大学行事等の利用は一つの方策かもしれない。