VISUAL TRAINING IN VIRTUAL WORLD

A comparative study between traditional learning versus learning in a virtual world

WALAIPORN NAKAPAN AND SUPATTRA RADSIRI
Rangsit University, Patumthani, Thailand
walaiporn@rsu.ac.th

Abstract. This paper presents a comparative study of Architecture students who study in a tradition learning environment and Innovative Design students who study in a 3D virtual environment. Both groups share the same objectives. Their learning pattern went through a three-step learning process where issues related to Design Composition theory were inserted. A survey and an in-depth interview showed a discontinued creative process amongst Architecture students due to class management. It showed that Innovative Design students should have more small assignments to better understand issues related to Design Composition theory with emphasis on developing their communication skill in using Visual Training technical terms. The differences between the two learning approaches were discussed.

Keywords. Visual training; OpenSim; design learning; virtual world.

1. Introduction to visual training at Rangsit University

Visual Training is a class where students learn about visual elements in order to develop skills and understanding of the artistic composition theory, starting in the arrangement of two dimensional elements and developing into more complex three dimensional designs. In a traditional Visual Training class, students use conventional tools like drawings, paintings, and 3D models (both physical and computerised) in their design.

     Last year (October 2010 – January 2011), we introduced a Virtual World to a small group of students by using OpenSim (Nakapan and Gu 2011). OpenSim showed potential to serve as an alternative platform for design and
collaboration. It responded satisfactorily to most of the issues investigated in the Visual Training class, especially basic visual elements (dot, line, plane, colour, and texture) and issues related to the relationship between humans and environment (human scale, 2D, 3D elements). However, the available papers did not thoroughly investigate how the platform responds to more in-depth issues in design composition theory where the meaning is involved, such as identification of character, sensory, mood and sequence.

This paper aims to investigate these issues of Visual Training. Its objective is to show how learning in a virtual world can respond to issues related to Visual Training, in comparison to traditional learning. The paper also aims to show the limits of a Virtual World learning environment and how assignments have to be adjusted in order to meet the objectives of the class.

Many similar works are found in the field of Virtual World learning. Some focus on the communicative aspect, such as Clark and Maher (2005) that studies the role of place in a virtual learning environment for digital media design in the context of Virtual Design Studio. Abdellatif and Calderon’s study (2007) describes a demonstrative experiment where students had to communicate with their tutor and display and describe their projects at a distance, in a purposely designed criticism space in Second Life. Some are more interested in the collaborative aspect of the virtual world. For example, Hoog et al. (2007) from TU-Vienna provides a 3D virtual campus as an extension to the existing Moodle and has tested three virtual environments as collaborative labs (Open Croquet, Blender and Second Life), for teaching architecture, and as digital environmental design tools. Merrick and Gu (2011) analyses virtual worlds with reference to the technological facets that can support collective intelligence in design, presenting the case of *Lego Universe*.

2. Learning process in two parallel classes

The class begins in July 2011 with two groups of students. One is a large group of 300 students in the Architectural Program who learn in a traditional Visual Training class. A smaller group consists of 20 students from the Innovative Design Program who do their assignments in Virtual World (OpenSim). These two groups share the same course syllabus and core lectures during the first two years. The assignments vary according their learning environment and the given assignment.

2.1. THREE STEPS LEARNING PROCESS

The learning process consists of three steps, one for each learning objective. The first step is “research and analysis” where students learn to search for
information that supports their idea. The second step is “logical and divergent thinking” where the students learn to find alternative solutions to a given design problem. The third step is “logical and creative thinking” where students create a small architectural piece integrating all the design issues they have learned. Communication is part of every step of the learning process and students are required to communicate their thinking and design via various group presentations and discussions.

2.2. ISSUES RELATED TO DESIGN COMPOSITION THEORY

These in-depth issues related to design composition theory are inserted into the three-steps learning process in the Visual Training class:

1. Identification of character,
2. Transformation of context,
3. Visual Elements (after Identification of Character + Transformation of Context),
4. Design Composition,
5. Mood,
6. Sensory,
7. Human scale,
8. Sequence.

While Identification of Character corresponds to “research and analysis” and Transformation of Context corresponds to “logical and divergent thinking”, the majority of the issues (no. 3–8) are introduced in the last step of “logical and creative thinking” at which point architectural-related issues are introduced.

2.3. TWO DIFFERENT APPROACHES

For the two groups to meet the same objective of the class we took different approaches in the problem given to Architecture students and Innovative Design students. A bottom-up approach is used with Architecture students who have to identify the character of an animal of their choice and transform this into 2D and 3D models. Due to the limitations of the Virtual World platform, a top-down approach is used with Innovative Design students who have to imagine an “Avatar World”, a biosphere based on their research of real-world information (the planet, fauna, flora, intelligent species, …).

Once the animals and the “Avatar Worlds” are identified, both approaches have to undergo a transformation of context. The objective is to identify the result from a change of environment and to find a solution for survival (redesign). The situation given to Architecture student is to identify the mutation of animals resulting from a rise of global temperature. Innovative design stu-
dents have to identify the adaptation of the imagined “Avatar World” in order to create it on a 256 × 256 sq-m island in OpenSim.

Architectural Design is introduced towards the end of the class. Architecture students have to design a pavilion based on the identified animal character, while Innovative Design students have to build a pavilion to exhibit of their “Avatar World”. At this point of time lectures about visual elements and design composition theories (sequence, sensory, mood, …) are given.

3. Students’ learning outcome

The following pictures show the learning outcome of the students, resulting from the three-step learning process. Figure 1 shows the learning outcome of Architecture students (upper row: an analysis of the cheetah’s life, middle row: an analysis of the cheetah’s mutation due to rise of temperature on Earth, and lower row: a final model of a pavilion inspired by the cheetah).

Figure 1. Learning outcomes of Architecture students.

Figure 2 shows the learning outcome of Innovative Design students (upper row: a conceptual video, middle row: a Machinima (story telling video) showing a transformation of context from imagination to OpenSim, and lower row: a final video of an exhibition of the avatar world).

Figure 2. Learning outcomes of Innovative Design students.

4. Questionnaire

A questionnaire is used to compare the learning outcome of the two groups e.g. how well students understand or apply each design issue introduced in the
class. Using Likert scale (Likert 1932) the interpretation of the results follows this guide based on an interval scale of the average score: 1–1.8 very badly, 1.81–2.6 badly, 2.61–3.4 neutral, 3.41–4.2 well, 4.21–5.0 very well. Table 1 shows the 8 questions that are asked in the questionnaire according to each design issue, with one additional open-ended question.

**TABLE 1. Questions asked in the questionnaire.**

<table>
<thead>
<tr>
<th>Design Issues</th>
<th>Architecture students (Bottom-up approach)</th>
<th>Innovative Design students (Top-down approach)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identification of Character</td>
<td>After you have studied about an animal of your choice, how well can you identify its character?</td>
<td>When you have studied about existing things in real world, how well can you create an imaginary world to be of a unique character?</td>
</tr>
<tr>
<td>2. Transformation of Context</td>
<td>How well can you analyse the mutation of an animal for its survival due to a rise of temperature?</td>
<td>How well can you transfer your imaginary world onto the 3D virtual world (OpenSim)?</td>
</tr>
<tr>
<td>3. Visual Element (+ Identification of Character + Transformation of Context)</td>
<td>How well can you interpret an animal’s character and its mutation due to the transformation of context into visual elements?</td>
<td>For the creation of your avatar world on OpenSim, how well can you convey the identity of your avatar world into visual elements?</td>
</tr>
<tr>
<td>4. Composition</td>
<td>After you have studied about design composition theory, how well can you use it to improve your design?</td>
<td>After you have studied about design composition theory, how well can you use it to improve your design?</td>
</tr>
<tr>
<td>5. Mood</td>
<td>How well can you use the character of an animal to create mood in your design?</td>
<td>How well can you use the character of your avatar world to create mood in your design?</td>
</tr>
<tr>
<td>6. Sensory</td>
<td>How well can you use the character of an animal to create sensory in your design?</td>
<td>How well can you use the character of an animal to create sensory in your design?</td>
</tr>
<tr>
<td>7. Human Scale</td>
<td>How well can you create spaces that correspond to human scale?</td>
<td>How well can you create spaces that correspond to human scale?</td>
</tr>
<tr>
<td>8. Sequence</td>
<td>How well can you create sequence that result in the perception of mood?</td>
<td>How well can you create sequence that result in the perception of mood?</td>
</tr>
<tr>
<td>9. Open-ended question</td>
<td>How will you use the knowledge from Visual Training class in architectural design?</td>
<td>How will you use the knowledge from Visual Training class in architectural design?</td>
</tr>
</tbody>
</table>

Table 2 shows that students perceive they can understand the identification of character well (3.74 for Architecture students: 4.11 for Innovative Design students), can redesign due to the Transformation of context well (3.58:3.78, can
create mood well (3.63:3.89), can create sensory experience well (3.47:3.89) and can create sequence for the mood well (3.45:4.11).

However, Architecture students indicate they can use visual elements to interpret the mood well (3.66), while Innovative Design students indicate they can do it very well (4.22). Architecture students indicate they can use design composition well in their design (3.95), while Innovative Design students indicate they can do it very well (4.44). Finally, Architecture students indicate they can create space according to human scale well (3.68), while Innovative Design students indicate they can do it very well (4.22).

<table>
<thead>
<tr>
<th>TABLE 2. Questionnaire results.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steps</strong></td>
</tr>
<tr>
<td>Research and Analysis</td>
</tr>
<tr>
<td>Logic and Divergent thinking</td>
</tr>
<tr>
<td>2nd half of the class</td>
</tr>
<tr>
<td>Logic and Creative Thinking</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

It is inquisitive that the results show that Innovative Design students, who learn in a virtual environment, outperform the Architecture students in all questions. This raises the question why these students are so confident. When looking at the responses to the open-ended question “How will you use the knowledge from Visual Training class in architectural design?”, Architecture students
emphasise the visual issues (character, mood, visual element, sensory, space, sequence, ...), whereby Innovative Design students talk more about design process, variety of design, and new design. A qualitative approach seems necessary to find more answers to these questions, as well as to suggest how to improve future classes.

5. In-depth interview

An in-depth interview is used to answer the questions arising from the results of the questionnaire. The interview applies the same guidelines as the questionnaire. However, students are encouraged to give an explanation to the quantitative result from the questionnaire and let us find out why it was so. 10 Architecture students and 7 Innovative Design students were interviewed. The following results are supported by analysis of the teachers:

5.1. RESEARCH AND ANALYSIS

In the Research and Analysis part, Architecture students had to extract the character of an animal of their choice. They indicate they had to change the group -and the animal they analyse- so often that it discontinued their thinking process. It would have been better if they stayed in one group and analysed the same animal. Some students indicate a lack of analytical skill. Since some animals consist of so much information, they could neither analyse nor clearly organise their ideas, in order to provide a summary of essential information.

Innovative Design students were to imagine an Avatar World after they studied real-world information. Some indicate they didn’t really like the research part at first and preferred to imagine out of thin air. However, they do belief that the research allowed them to know more and to create more realistic materials, whereas imagination only comes from existing knowledge and can be limited.

5.2. LOGIC AND DIVERGENT THINKING

In Logic and Divergent Thinking related to the transformation of context, Architecture students were asked to analyse the mutation of an animal due to a 1–7 degrees rise of temperature on Earth so the animal could survive in the new context. The students believe they did it quite well, apart from the class-management issue mentioned earlier. Most of the students had good logic and divergent thinking, as well as good imagination and creativity in storytelling. A variety of techniques were used such as drawing on paper or screen, dough- and paper models, etc. However, some students experienced limitation in making an understandable video presentation within the given time limit of 2 minutes.
Innovative Design students were asked to create an imagined Avatar World in the 3D virtual world as a movie set for their Machinima. They believed they had to change many things because of the limitations of the virtual world. For example, a rounded world had to be changed to a flat surface as they couldn’t show the dark-bright side of the surface and couldn’t adjust the gravity of the virtual world. They also indicated that, even though OpenSim provides substantial freedom to think and create, it is more suitable for a simulation of real-world objects than for an imaginary world.

5.3. LOGIC AND CREATIVE THINKING

In Logic and Creative Thinking, a number of small assignments were given to Architecture students according to the provided lecture (visual elements, sensory, mood, …). The students indicated this was too much work and that they didn’t have enough time to complete a satisfactory concept. The assignment, that required students to incorporate many design composition theories simultaneously (i.e. creating a habitat for an animal using sequence, sensory and mood), created confusion. However, during the interview, students could express their idea quite well using Visual Training technical terms. After a lecture in design composition theory, this was the first time they worked individually (they worked in groups before) and they lacked confidence as they did not have sufficient skills to put theory into practice. Some students also had problems in choosing the right material to make a model that best represented their ideas. Innovative Design students say they prefer the assignments on OpenSim because it was fun and less tedious than the assignments of Architecture students. They also enjoyed making the paper model as this allowed them to understand the differences between virtual-world objects and real-world objects. Even though their work seems to show an understanding of the issues related to design composition theory, they struggled with using the technical terms of Visual Training during the interview.

5.4. OPEN-ENDED QUESTIONS

Both groups indicate the knowledge they gained from the class was useful and that they will apply it in their future designs.

6. Comparison between the two approaches

The difference between traditional learning versus learning in virtual world can be summarised as followed:

1. Reality vs. Imagination - media wise: The learning objective of Architecture students was based on reality (an animal). Students think that physical models
have limitations in creating work and are tedious. The learning objective of Innovative Design students was based on imagination (an Avatar World). These students think that a virtual world is more suitable for real-world objects due to some limitations of the virtual world. From a teacher’s point of view, physical models do have more limitations than virtual world models. Although it was a new environment, Innovative Design students took very little time to learn. They could create larger works with less effort in the same timeframe. They could also experiment with different ideas, shapes, forms and materials and subsequently were more confident in what they were doing.

2. (Partly) disrupted vs. continuous creative process: In both approaches the students learned to search, analyse and synthesise; the basis for logical thinking. Students created works from the same theme (animal/avatar world) during the three-step learning process, which is a continuous and relevant creative process. Even though the creative process of Architecture students was discontinued, this flaw is considered to be minor thanks to the continuous theme. On the other hand, Innovative design students had to work week-by-week towards the single-building exhibition pavilion for their Avatar World. The teacher realised that the work required substantial output and broke the work down into small successive parts for each week (case studies, conceptual design, design development,…). The Innovative design students were more confident in their progress and unintentionally learned about the design process.

3. Poor vs. enhanced perception of space: In the final project of the Architecture students it is found that physical models have more limitation than virtual models in terms of perception of space (especially interior space). Physical models were small and mostly allowed perception of exterior space and form, while virtual models allowed more freedom to explore both exterior and interior space.

4. Real world Collaboration vs. Collaboration in virtual world: Innovative Design students and teachers could freely collaborate during and after classes in the shared space via their personalised avatar. Architecture students were limited to meet in person with their collaborative partners. Innovative Design students also presented their work in the form of Machinima. Pedagogical value can be found in Machinima as a storytelling tool, as well as in how it offers a learning environment for collaborative digital media practices in the classroom (Lowood and Nitsche 2011). In our case, architecture became a background of the story that students recorded using their own avatars; a reason why they perceived it to be less tedious and more “fun”.

5. Bottom-up approach vs. Top-down approach: the results reflect the different approaches of the two groups of students. Architecture students began with a small scale object (an animal) and developed their work into a bigger form of architecture (a pavilion inspired by the animal). Innovative Design students began with a very large concept and ended with architecture (an exhibition pavilion for the avatar world). Even though both approaches seem to meet the
same grounds, it is found that the work of Innovative Design students was relatively larger compared to the work of Architecture students. Innovative Design students could also give more detail to their works.

7. Conclusion and discussion

The different learning outcomes reflect the different approaches of the groups. However, the final design of the pavilion shows that both groups of students met the objective of the class. This does not conclude that one approach is better than the other but presents elements of reflection for lecturers who would like to explore a virtual-world learning environment.

Student’s confidence has been mentioned all along in the above analysis. Architecture students seem to be confused at first but could express their work very well at the end by using technical terms. On the other hand, Innovative students were more confident as they developed step-by-step; they could experiment with different ideas in a virtual world and explored every detail of their work before submission. However, they lacked the skills to use technical terms. In future classes, visual elements and design composition theory should be emphasised to Innovative Design students, while the architectural design process is yet to be introduced to Architecture students. For next year it is recommended that Architecture students have more time to develop their concept of a single animal. For Innovative Design students it is recommended they have more small assignments based on the lectures about issues related to design composition theory. Emphasis should be given to their skills to communicate by using the technical terms of Visual Training.

References


