"Show-And-Tell-And-Let-Apply (SATALA): An Innovative Multi-Media Approach for Teaching Manual Architectural Engineering Drafting"

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Background

Visualization ability is essential for architectural drafting and blueprint reading. From preliminary sketching, to design, to implementation, architecture students and practitioners need to find innovative ways through which they enhance their visualization and problem solving skills. (1)

This paper presents selected visual examples from an ongoing experiment that was started in 1998 at the School of Technology, Eastern Illinois University to examine the (SATALA) approach adopted by the author for his Architectural Drafting and Blueprint Reading class, using some of the features of Microsoft PowerPoint software.

From hand-drawing geometric shapes such as ellipses, to understanding architectural theories and concepts such as axonometric or perspective views, to shades and shadows, students' comprehension of subject matter as well as their problem solving ability are greatly enhanced through adopting the (SATALA) approach in lecturing. This paper also briefly presents samples of surveys' results that were conducted to evaluate that instructional experiment and to help explore the presentations' effectiveness in Architectural Drafting and Blueprint Reading classroom.

Introduction

Historically, Architectural Drafting and Blueprint Reading courses have not been very user-friendly to some students. Inherently, those courses require superior visualization skills. Visualization is an essential tool for the design, and the creation and/or the interpretation of drawings. As visualization is also a developed skill, students often become frustrated by their inability to readily visualize objects presented in architectural engineering drawings. Students not only vary in their natural abilities or visualization skills, but also

they do have diverse backgrounds, learning styles, and career objectives.

Moreover, courses presenting architectural drafting basic concepts are, most of the time, offered as introductory courses in many engineering or technology curricula. They are presented to freshmen students who most probably are not yet oriented, or certain enough about their abilities or even their interest in those disciplines. Unfortunately, this could turn-off some students, leading them to become less motivated or enthusiastic. If their stamina is not strong enough to help them survive this frustrating period, students may undergo painful experiences, or even quit the discipline altogether.

Architectural Drafting and Blueprint Reading courses, however, need not be such an obstacle. Indeed, they can be made easy for many students through the innovative use of Microsoft PowerPoint software capabilities to create effective animated multimedia graphical presentations. In fact, preparing PowerPoint slides for Architectural Drafting and Blueprint Reading courses was initiated, in the first place, to meet the individual needs of undergraduate students at Eastern Illinois University as they learn concepts that require special visualization skills.

Exploring new multimedia instructional methods is vital as they can add important aspects to the cognitive abilities and visualization skills of on-campus undergraduate students. [2] Microsoft PowerPoint software capabilities can be utilized to create simple but effective, animated, multi-media, graphical presentations that enhance students' visualization skills and give them the know-how to hand-solve a variety of projection problems, geometric shapes drawings, and architectural engineering concepts, in an easy and affordable way.

Rationale

Since their infancy, this generation of on-campus undergraduate students grew up with different forms of multimedia ranging from toys to video games, electronic gadgets, computers, Internet, radio, television, video, CD/DVD, and a long list of appliances. Reaching out to students "in their own language" naturally calls for the use of multi-media presentations that enhance traditional lectures. [3]

This becomes even more important, given other factors such as the variety of students' backgrounds, visualization natural abilities, the wide range of subject matter content, the relatively limited time for lecture, lab, or homework, and the teaching styles of instructors -- all of which require more insight, flexibility and careful planning to accommodate.

Multimedia is a powerful instructional, pedagogical tool for the teaching of Architectural Drafting and Blueprint Reading. [4] Lecturing on architectural engineering theories and concepts in a tangible way polishes the students' imaginative ability, helps them visualize objects more easily, and leads them to a better comprehension of the subject matter. [5]

When multimedia is used in a prudently designed manner to present the fundamentals of Architectural Drafting and Blueprint Reading to students, it can motivate them to learn

more of the topic without much difficulty. [6] Later, it would help them to easily apply the knowledge they attain in the workplace. Furthermore, lectures and teaching materials in multimedia presentations are often already prepared before hand, for the most part. This allows faculty to concentrate during the lecture on direct and spontaneous student interaction, which is a crucial element in effective teaching.

The PowerPoint Presentations "Show-and-Tell-and-Let-Apply" (SATALA) Approach

It was found that students in general prefer to receive and apply small manageable amounts of information that are released to them at successive increments over short intervals of time. The SATALA approach is kind of a "how-to" instruction that enables students to work independently which, in turn, enhances their sense of achievement. The PowerPoint presentations SATALA approach bridges students' visualization gap, eliminates their frustration, and makes the drawing process more fun and self-fulfilling.

The SATALA PowerPoint presentations typically walk the students through the various steps of a particular solution or concept -- one step at a time -- and conclude with the correct results. Students are instructed to follow and apply each step in their notes as it appears on the screen in front of them. Students are also instructed to immediately comment or ask the instructor, should they have any question.

During the SATALA presentations, students indeed become fully engaged in the show -- using their eyes, ears, hands, and minds all at once. The SATALA approach appeared to effectively enhance the students' sensory and cognitive experience by using PowerPoint capabilities in presenting forms, shapes, animation, and color-coding to simply construct the drawings in front of them from simple to compound -- one step at a time. [7] In some instances, the show would be repeated one more time without interruption as a review, to show the whole thing from start to end.

Following the show, students are generally expected to solve similar architectural drafting problems by pencil at a drawing board. At that time, students would still have access to the PowerPoint presentation in order to encourage their further interaction by replaying it, or any parts thereof, any number of times at their own pace, as need be. As students visualize architectural engineering concepts presented on the screen, they in fact exercise a developing skill -- an experience that would otherwise be intimidating, tedious, and time consuming if done using a printed worksheet.

Indications of the success attained through using the SATALA approach PowerPoint presentations are monitored through the students' overwhelming positive response to exploratory presentations adopting this mode of delivery. Of course, this would eventually be reflected also in enrollment and retention statistics.

Discussion

The ability to visualize objects and situations in one's mind and to manipulate those

images is a cognitive skill vital to many career fields, especially those that require work with graphical representations such as visual arts and engineering. Individuals vary widely in these skills. Some persons are naturally more gifted than others. However, those less gifted can, and should, enhance their visualization skills over time through regular practice and self-motivated serious training.

The PowerPoint presentations of various architectural engineering problems and concepts impart to students the know-how in a simple, attractive, and even entertaining way. The SATALA approach would help students arrive at a fast solution to a problem without the need to go through excessive verbal instruction, whether read or heard, that -- in some instances -- can easily become overwhelming.

Moreover, the use of a multimedia instructional approach in architectural engineering drawing allows for more individual, self-paced instruction, and leads to further development of visualization skills through the use of interactive PowerPoint presentations. The entertaining presentation through the capabilities of such software generates students' enthusiasm for the course and builds up their self-confidence, making them feel good about themselves and what they are learning. The heartening sense of achievement which students attain, and their feeling of content and self-fulfillment would encourage them to achieve even more, and to excel.

Preparing PowerPoint slides is a very time consuming, sometimes frustrating, process that also requires trained faculty with technical skills to effectively use the software. A single slide can have 80 to 100 animations and would easily require between 4 to 5 hours to be prepared. Variables at play include the selection of line shape, thickness, color [3], and animation, besides any written or vocalized instructions. More importantly, the sequence of steps and their timing must be planned in such a way that would effectively reach the students in a logical and smooth way.

Having said that, it must also be noted that the time and the effort invested in preparing those PowerPoint slides eventually pay high dividends in the many students who get a better understanding of the subject matter. This, in turn, improves their performance during their college years, and later in the work place.

Software

The features of Microsoft PowerPoint software (Office 97 or Office 2000) nicely fit the anticipated effectiveness of the SATALA approach adopted for lecturing, which significantly helped change the Architectural Drafting learning and teaching paradigm, and enhanced students' education. [8] The interactive PowerPoint presentations give immediate instruction to students, and have been proven to effectively improve the students' visualization skills that are essential to generate and interpret complex multiview drawings and pictorials.

Students rightfully expect the computer to be the natural medium for the presentation of

information in architectural drafting classes. It should be noted, however, that the capabilities of Microsoft PowerPoint software and its potential usefulness in improving the teaching/learning of architectural drafting must be discretionary introduced to the students. To safeguard against overwhelming the students, only the features of PowerPoint that serve a particular purpose should be used, and in small increments as need be -- starting from simple architectural drafting concepts and procedures, and building up to the compound.

Three Selected Typical Architectural Drawing Case studies

This paper presents three selected architectural drawing case studies, including:

1) Multiview Orthographic Projection - The Loop Principle.
2) Drawing an Ellipse - The Revolution Method.
3) Drawing a 2-Point Angular Perspective of an Exterior – The Office Method.

Case No. 1: Multiview Orthographic Projection - The "Loop" Principle [9]

A simple and basic concept in multiview orthographic projection is that the three views of any point are connected through what can be called a "closed loop" of projection lines (Figure 1).

A horizontal projection line connects the frontal and the profile views, a vertical projection line connects the frontal and the top views, and the top and the profile views are to be connected in such a way that "closes" the loop. No matter how many points are there in an object, the three views of each single point are connected through their own unique loop (Figure 2).

Surprisingly, quite a few students (15%) needed some time to realize the simple and basic fact that what we have in multiview orthographic projection is: *three views of a single point, and NOT three points -- three views of a single line, and NOT three lines -- three views of a single plane, and NOT three planes!* The PowerPoint presentation makes it easy for those students to immediately visualize the Loop Principle and how it works. From there, they can easily solve most any assigned multiview orthographic projection problems.

Case No. 2: Drawing an Ellipse - The Revolution Method

The systematic steps to draw an ellipse by the Revolution Method (Figure 3) can be found in most architectural drawing or engineering graphics textbooks. "*Step 1: When the edge view of a circle is perpendicular to the projectors between its adjacent view, it appears as a circle. Mark equally spaced points around the circle's circumference and project them to the edge. Step 2: Revolve the edge view of the circle and project the points to the circular view. Project the point vertically downward to obtain the elliptical view.*" [10]

It was observed that less than 2 % of the students could draw the ellipse following the above instructions -- and with much assistance from the instructor. The PowerPoint presentation shows those same steps, but animated and revealed one step at a time. After a single showing, 85% of the students were able to draw the ellipse without further help from the instructor, 12% needed a second showing, and 3% needed three or more shows, in addition to the instructor's help.

Case No. 3: Drawing a 2-Point Angular Perspective of an Exterior – The Office Method.

The systematic steps to draw a 2-point angular perspective of an exterior – The Office Method can be found in most architectural drawing textbooks (Figure 4). [11] One of the main problems here is that students see the figure accompanying a text "all at once." Figures are usually, and rightfully, supplied to help students visualize and understand a certain problem or concept. Unfortunately, however, they sometimes intimidate and even turn off a good number of students as they try to read the drawing, not knowing exactly from where to start and how exactly to arrive at the end product.

It was observed that 15 % of the students could completely solve the problem following those instructions -- and with much assistance from the instructor, while 28% could arrive at only a partial solution. The PowerPoint presentation shows those same steps, but animated and revealed one step at a time. After a single showing, 85 % of the students were able to solve the problem without further help from the instructor, 10 % needed a second showing, and 5% needed three or more shows, in addition to the instructor's help.

Future Work

This experiment opened the door for other possibilities to explore and expand to in the area of multimedia instructional technology and curriculum such as:

1. Expanding the topics presented in this mode of delivery and revitalizing traditional teaching methods to improve the teaching/learning process.

2. Providing continuity between lecture presentations and lab/home work and using lab assignments and homework problems as self-teaching instructional tools in stead of confining them to a mere testing tool. This may be done through incorporating interactive software that would provide immediate feed back after the students submit answers. The feedback would indicate the score for each problem and how long students take to finish it, with the correct solution provided when students fail to reach it on their own.

3. Preparing short course tutorials for distance learning and self-paced instruction using other software.

4. Introducing selected PowerPoint/multimedia presentations into K-12 instruction to increase architectural engineering awareness among students at an early stage in their

education. This can also help in marketing and recruitment efforts into engineering and technology education.

Conclusions

The traditional Architectural Drawing and Blueprint Reading lecture is substantially upgraded through adopting innovative mediated teaching methods that provide the students with the opportunity to electronically construct – step by step – complicated geometric shapes, and apply architectural drawing concepts.

The use of "show-and-tell-and-let-apply" (SATALA) multi-media presentations in the delivery of Architectural Drawing and Blueprint Reading courses ignites students' imagination and stimulates their visualization abilities, both of which being basic elements in mastering Architectural Drawing and Blueprint Reading theories and applications.

The SATALA PowerPoint presentations have significantly assisted the development of students' visualization skills, making them better equipped to understand and apply architectural drawing concepts effectively. Students' better comprehension of the subject matter is reflected in their improved performance and superior grades in assignments and exams, as well as in their positive feedback on surveys.

Developing the SATALA PowerPoint presentations for use in architectural drawing applications is a tedious and very time consuming process that also requires training and technical skills to effectively use the software. However, the development of such presentations has been a constructive experience as they have been positively received by students.

With the success that SATALA PowerPoint presentations achieved so far, a great part of that, however, must be rightfully accredited to the face-to-face delivery element in the lecture. Most students still seem to have the need to "listen," "see," and "interact" with a "physically present" instructor. Students' ability to express ideas and personally communicate with the instructor keeps many students interested and active in a course. It appears that technology is still unable to completely replace the human factor in the teaching/learning process.

Bibliography:

1. Holliday-Darr, K., Blasko, D.G., and Dwyer, C. (2000) "Improving Cognitive Visualization with a Web Based Interactive Assessment and Training Program," *Engineering Design Graphics Journal, Vol. 64, No. 1, pp. 4-9.*

2. Crown, S.W. (2001). "Improving Visualization Skills of Engineering Graphics Students Using Simple JavaScrpipt Web Based Games," *ASEE Journal of Engineering Education, Vol. 90, No.,*

pp. 347-355, Washington, D.C.

3. Seddon, G. M, and Shubber, K. E. (1985). "The Effects Of Color In Teaching The Visualization Of Rotations In Diagrams Of Three Dimensional Structures," *British Educational Research Journal, Vol. 11(3), pp. 227-239.*

4. Croft, F. M. (2001). "Using CADKEY to Solve Shortest Connector Problems," *Engineering Design Graphics Journal, Vol. 65, No. 2, pp. 6-13.*

5. Wahby, W.S. (October, 2002). "Multi-Media Applications for Engineering Graphics Courses," *Proceedings, the Inaugural ASEE/SEFI/TUB International Conference on Global Changes in Engineering Education,* Berlin, Germany.

6. Burleson, W., Ganz, A., and Harris, I. (2001). "Educational Innovations in Multimedia Systems," *ASEE Journal of Engineering Education, Vol. 90, pp. 20-31,* Washington, D.C.

7. Wahby, W.S. (November, 2002). "Visualization Enhancement in Teaching Engineering Graphics Concepts Through a "Show-and-Tell-and-Let-Apply" (SATALA) Approach: A Case Study," *Proceedings, the American Society for Civil Engineers (ASCE) Annual Conference, 150th Anniversary ,* Washington, D.C.

8. Wahby, W.S. (June, 2002). "Enhancing Engineering Graphics Courses Through Animated, Sophisticated, Multi-Media, Graphical Presentations," *Proceedings, the American Society for Engineering Education, Annual Conference,* Montreal, Canada.

9. Wahby, W.S. (2001). "Using PowerPoint to Visualize Engineering Graphics," *Brown Bag Lunch, an Eastern Illinois University presentation,* Charleston, Illinois.

10. Earle, J.H. (2001). "Engineering Design Graphics," *10th Edition,* Prentice Hall, Upper Saddle River, NJ.

11. Muller, E.J., and Fausett, J.G., and Grau, P.A. (2002). "Architectural Drawing and Light Construction," *6th Edition,* Prentice Hall, Upper Saddle River, NJ.

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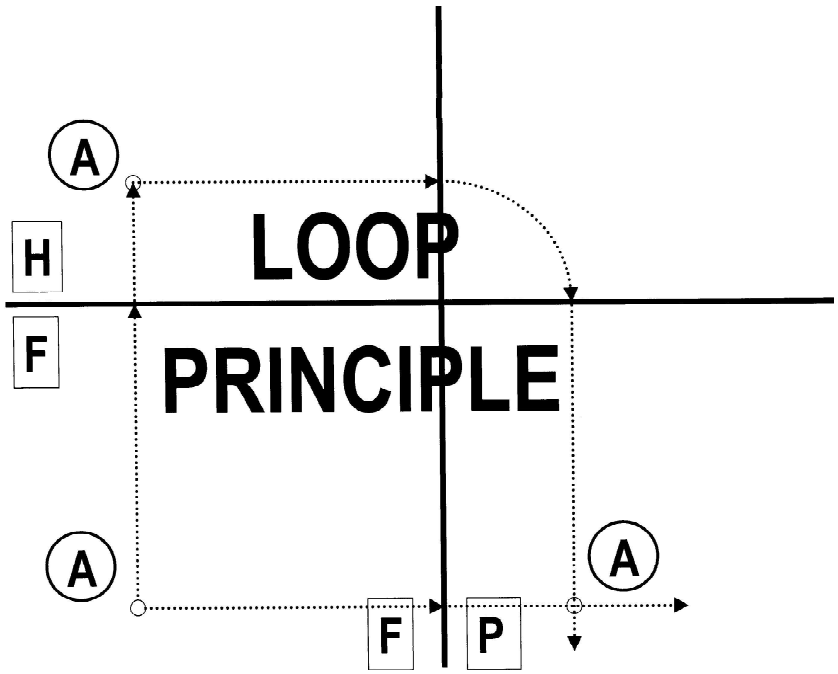

Figure 1. The Loop Principle

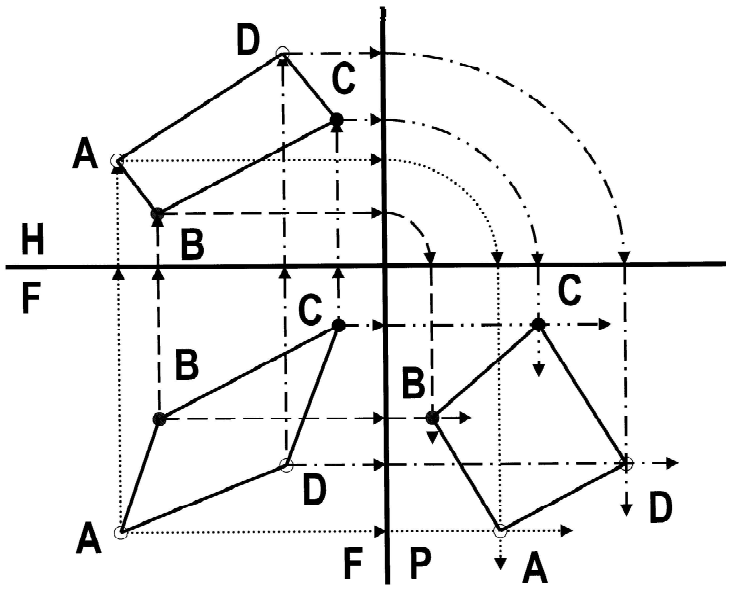

Figure 2. The Loop Principal: Points, Lines, and Planes

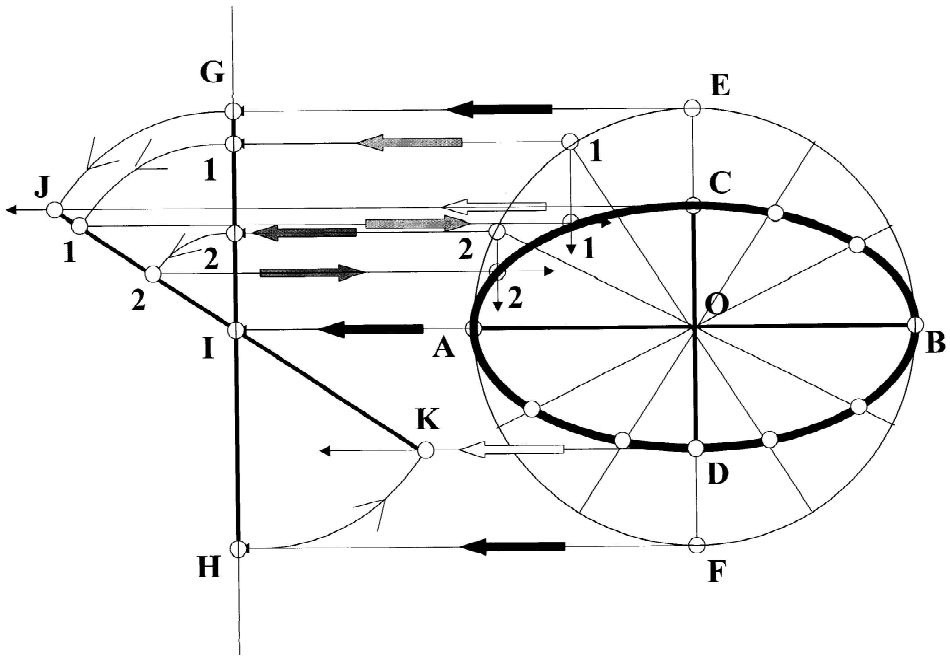

Figure 3. Drawing an Ellipse - The Revolution Method

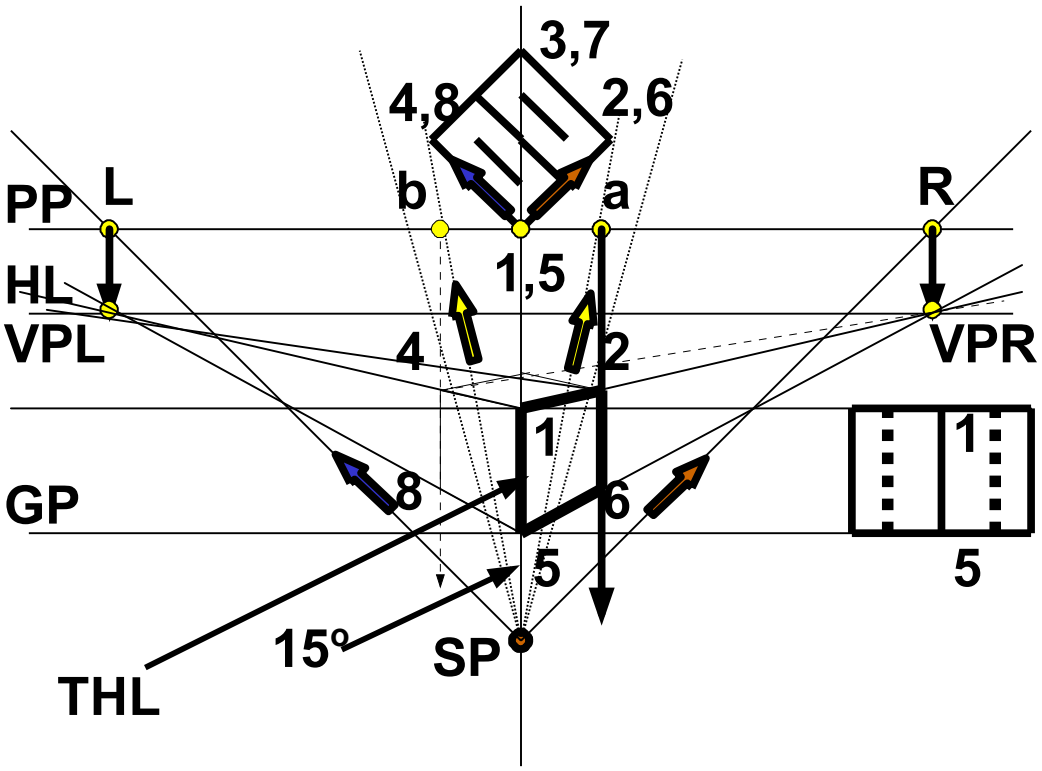

Figure 4. Drawing a 2-Point Angular Perspective of an Exterior – The Office Method