

# Forum: Teaching Gems for Computer Science and Engineering

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## Abstract

Moderators and attendees of this forum will present, discuss, and assess examples of "best practices" for teaching computer graphics to computer science and engineering students. Types of "teaching gems" to be presented include: classroom lectures and demonstrations, lab exercises, homework projects, self-instruction techniques such as tutorials, demo programs, and Web applets, use of analog models, examples from industry and the rest of the "real world", and field trips (real and virtual). The forum moderators will contribute presentations by electronic submission from virtual attendees prior to the conference and by attendees on site during the forum session. Three outcomes are anticipated from this forum: 1. presentation of several teaching gems, 2. group analysis and discussion of how best to apply each gem in a course and its learning effectiveness, and 3. posting of the results for public access on the SIGGRAPH Education Committee web site, <http://www.siggraph.org/education>.

## 1 Introduction

Teaching computer graphics to computer science and engineering students presents both a challenge and an opportunity. The challenge is that engineering related disciplines require learning about computer graphics in a way that helps students discover the trade-offs between visual realism and cost of computation. The opportunity is that students in computer science and engineering have the prerequisite knowledge to understand these tradeoffs. And, many students in these disciplines have math and science knowledge that allows instructors to use problems and applications in these domains for demonstrations and assignments that increase the student's motivation and effectiveness for learning about computer graphics.

However, students can waste a lot of time while learning graphics if they get sidetracked on tasks that are time consuming but not essential to learning, or if they get held up by having to deal with technical problems. For example, students are often tempted to spend lots of time developing complex 3D geometry models on assignments where the complexity of the model is unrelated to the main learning goals. Another example is assignments that require students to write their own computer programs. Students often spend a lot of time debugging program errors that are not related to learning goals for the project. However, these students often are willing to invest time on such tasks because they mistakenly believe the tasks are part of their required learning, because they find them fun or challenging, and because they are accustomed to having to deal with technical details.

Thus, when teaching computer graphics in these technical disciplines, there is a critical need for learning guided by an experienced teacher using proven teaching techniques. Many experienced faculty have discovered classroom and laboratory techniques that help students learn more rapidly and avoid spending excessive time on tasks that don't contribute significantly to learning goals. This forum will present a collection of "best practices" for teaching computer graphics to computer science and engineering students.

## 2 Definition of "Teaching Gems"

The phrase "Teaching Gems" for computer graphics is derived from the titles of the popular series of "Graphics Gems" books published by Morgan Kaufmann Publishers [Glassner 1990; Paeth 1995]. At the 1999 Computer Graphics and Visualization Education conference in Coimbra, Portugal (<http://www.siggraph.org/education/conferences/GVE99/>), one of this forum's moderators Mike Bailey coined the term "Teaching Gems" as a label for a publicly accessible collection and archive of teaching resources. Other education conferences have sessions devoted to presentation of effective and novel teaching techniques, for example the annual ACM SIGCSE (Special Interest Group on Computer Science Education) Conference sessions titled "Nifty Assignments" [Parlante et al. 2002]. This forum will provide a means for members of the graphics education community to present and contribute to a teaching resources archive.

The teaching resources presented during the forum will include: classroom lectures and demonstrations, lab exercises and homework projects, self-instruction techniques such as tutorials, demo programs, and Web applets use of analog models (such as toys), examples from industry and the rest of the "real world", field trips (real and virtual), and any other method or technique offered by a contributor.

Teaching gems presented during the forum will be gathered from three sources: the forum moderators' personal experience, contributions submitted electronically prior to the conference (following a call for contributions made in Spring 2002 via electronic mail lists and web site postings, and) contributions from audience members.

The moderators anticipate that interaction with and discussion by the forum audience will allow not just presentation of computer graphics teaching gems, but also explanation and justification of their teaching effectiveness as well as ways to assess the outcomes of their use. Following the SIGGRAPH 2002 Conference a summary of the teaching gems presented, the discussions at the forum, and supporting materials for applying the gems will be posted on the SIGGRAPH Education Committee web site, <http://www.siggraph.org/education>.

## References

- GLASSNER, A. 1990. *Graphics Gems I*. Morgan Kaufmann Publishers.
- PAETH, A. 1995. *Graphics Gems V*. Morgan Kaufmann Publishers.
- PARLENTE, N., ESTELL, J. K., GARCIA, D., LEVINE, D. B., REED, D., AND ZELENSKI, J. 2002. Nifty assignments. In *Proceedings of the 33rd SIGCSE Technical Symposium on Computer Science Education*, ACM Press, D. Knox, Ed., ACM, 319–320.