

# REAssess: Resources for Educational Assessment

## Cases in Effective Assessment – Mark Guzdial

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### **Development and Assessment of a Media Computation Course** **Dr. Mark Guzdial, Georgia Institute of Technology** **Professor, College of Computing, and** **Director of Undergraduate Programs**



Dr. Mark Guzdial, of Georgia Institute of Technology, along with colleagues there and at other universities and colleges, is engaged in a comprehensive program of design, development and assessment of a media computation course. He has developed, and allows other faculty to share and adapt, a series of survey instruments, as well as interview guides, to determine the impact of his course development work. He measures, in particular, student attitudes, engagement, attrition and retention. The results of this assessment work have been published widely.

Dr. Guzdial is a professor in the College of Computing, the Director of the *Collaborative Software Laboratory*, Lead PI on the project "Georgia Computes!", an *NSF Broadening Participation in Computing Alliance* grant, and Co-PI of the Institute for Personal Robots in Education.

### ***Assessment Situation***

The general goal of Guzdial's media computation project is to build an engaging introductory CS sequence, as reflected in higher retention in the course and a decreased rate of course withdrawals.

### ***Course Description***

#### ***Course***

At Georgia Tech, the course is CS1315, "*Introduction to Media Computation*". (This case study also discusses work the CS1316 course, "*Representing Structure and Behavior*").

#### ***Course Goals***

The course is designed to address content defined by the ACM and IEEE computing standards (2003).

#### ***Course Learning Outcomes***

Specific objectives are listed in the syllabus on the course web site, which is available at: <http://coweb.cc.gatech.edu/cs1315> .

Examples:

- Students will be able to read, understand, modify, and assemble from pieces programs that achieve useful communication tasks: Image manipulation, sound synthesis and editing, text (e.g., HTML) creation and manipulation, and digital video effects.
- Students will learn what computer science is about, especially data representations, algorithms, encodings, forms of programming.
- Students will learn useful computing skills, including graphing and database concepts.

Guздial notes that while the ACM and IEEE computing standards are taught, students in the various media computation courses referred to on his web site are not necessarily learning the same things as there is no standard test. The tests that may exist, for instance, presume that a particular programming language is taught; this is not the case at each university where this type of course is taught).

### ***Goals of the Assessment Work***

Guzdial's has many goals for his assessment efforts, but generally focuses on improving the engagement of students in the media computation course. He measures their attitudes toward the course and course processes at several stages throughout the course to determine the impact of the course. He is also interested in retaining students in the course and determining their longer-term attitudes about the course and about computer science activities.

Guzdial has built numerous research-based surveys and strategies for assessing media computation courses. His colleagues in these efforts are many, and have included Andrea Forte, and Allison Elliott Tew, Lijun Ni, and Brian Dorn (all currently or formerly of Georgia Tech).

Guzdial notes that the assessment techniques and tools he uses are being adapted by faculty in CS departments in various types of institutions. For instance, in some universities this type of course is simply an introductory course for majors, who would take it as their first, or as a remedial course; in others it is taken primarily by non-majors; in still others, part of this same content may be covered in a different course. At East Georgia Perimeter, for example, this content is covered as a module within a Java course.

### ***Assessment Approach, Strategies, and Tools***

Guzdial's assessment tools are available on his "Assessment Tools" web page at <http://coweb.cc.gatech.edu/mediaComp-teach/16>.

For the CS1315 course he has been using a general survey approach with some interviews along the way. Guzdial's web page illustrates a comprehensive approach (in what he calls a "Complete Package") to assessing the effects of a media computation course. He suggests faculty consider using surveys at various points throughout the course, both formatively, that is during the course to improve course processes, and also summatively, that is, at the end of the course. He provides a "**Consent Form Example**" that faculty may adapt to secure students' permission to participate in assessment research at the beginning of the course. He and his colleagues developed, and provide links for, in the "Library of Assessment Tools", surveys faculty may adapt, including several forms of a(n):

- **Initial Participant Survey**
- **Mid-Term Survey**
- **Final Participant Survey**

He also provides a **Longitudinal Survey** that he has used as a follow-up measure, a year after he first offered the CS1315 course.

Finally, he has developed an **Interview Guide** that he also uses as part of his research.

Guzdial's web site is also very useful to faculty who wish to adapt other surveys related to CS. For instance, on the Assessment Tools page (<http://coweb.cc.gatech.edu/mediaComp-teach/16>),

Guzdial provides links to other types of surveys, including:

- The "Computer Science Attitude Survey" adapted by E. N. Wiebe, L. Williams, K. Yang, and C. Miller (2003) from earlier work measuring mathematics attitudes by Fennema-Sherman.
- "Survey of Teachers' Attitudes Toward Computers" from the Texas Center for Educational Technology. Teacher Attitude Survey from TECT for measuring teachers' attitudes towards computers.
- Article by G. C. Townsend describing the "Computer Attitude Scale" developed by B. Lloyd and C. P. Gressard.
- A computer anxiety scale and a survey to track girls' attitudes toward an advanced math class.

### ***Findings***

Reports detailing the results of Guzdial and his colleagues' assessment research are available on his web site. Overall, he has found students' attitudes to be favorable, and has been able to utilize survey results both formatively, to improve the course as it proceeds, and summatively to improve the course over several semesters.

### ***Future Issues and Revisions***

In some of his more recent efforts, Guzdial has developed the CS1315 course to use the relatively simple programming language Python. However, there has been some pushback from faculty in other majors, who noted that students in those majors may prefer to learn a more well-known (outside CS) language like Java. For instance, Java is the language of advanced placement tests, and many high schools like to use this approach; they prefer not to teach two languages in these courses. Guzdial has written the textbook in Python, but has also rewritten the textbook in Java, so this class could be used as the second course in Java.

The new ACM recommendations for a model CS curriculum, however, do suggest teaching a simpler language in high school, such as Python. Georgia has revised and adopted these recommendations.

Measurement issues are very difficult and Guzdial and colleagues plan to address several issues in future work. Though they do use grades and final test scores, for instance, to measure learning, he cautions that GPA analysis can be problematic, and assessment tools for measuring learning also change over time or should be different in different courses. For example, in different courses, the same type of problem may be covered at very different times in a course, resulting in many weeks sometimes intervening between the time a topic was taught and when it is measured on the final exam. In some of his research he has found that using isomorphic problems on midterm and final exams in different courses is a problem. If, on the final exam an introductory question about arrays is asked, this may have been covered fifteen weeks ago in one class, but only four weeks ago in another.

As there is not a reliable and valid measure of CS knowledge, it is often difficult to validate the new measures that Guzdial and his colleagues are developing. For instance, in recent work with Tew, they are inventing a programming language that can be taught so all the questions would be in that language, with no advantage to anyone.

Guzdial is also working on adapting learning test items from existing popular textbooks, so there may be some agreement among CS faculty about what is common knowledge. He will be piloting these items this summer, 2007, with further development of distractor responses this fall.

### ***Advice for Other Faculty***

Related to the above discussion, Guzdial recommends faculty start from scratch when developing learning test items and to be careful about validations.

For his web site, one idea related to course and assessment development that has turned out to be valuable for media computation teachers has been to search for other faculty using his textbook and then to link to the schools who use his approach. He has asked other faculty how they have implemented the course or the assessment tools, and the results of their efforts.

Guzdial also recommends other CS faculty review important research on learning, such as the book, *How People Learn* [listed in Assessment Toolkit Focused Resources]. He also recommends they consider reading John Brewer's work, *Schools for Thought*, as he has

found it to be an accessible work arguing for a cognitive science approach to education. Guzdial has also found useful David Palumbo's famous meta-analysis paper contending that learning to program does not necessarily lead to learning higher-order thinking skills.

Regarding assessment in computer science, Guzdial has found Sally Fincher and Marian Petre's computer science education research book to be valuable. The first half of the book is about CS research, which, though not the same as assessment research, shares similar issues. They discuss how to study the CS classroom. The second half of this book focuses on tools and environments.

### ***For More Information***

For more information about Dr. Guzdial's assessment approach and tools, his "Assessment Tools" web page at <http://coweb.cc.gatech.edu/mediaComp-teach/16> provides all the tools, which may be adapted by other faculty.

Guzdial's Media Computation Teachers Web Site  
<http://coweb.cc.gatech.edu/mediaComp-teach> .

For more information about Dr. Guzdial and his colleagues' plans and ongoing work on media computation classes his planning web site is at  
<http://coweb.cc.gatech.edu/mediaComp-plan> .

Guzdial's "Reports on Using Media Computation"  
<http://coweb.cc.gatech.edu/mediaComp-plan/37>.

Guzdial's home page  
<http://www.cc.gatech.edu/~mark.guzdial/> .

Institute for Personal Robots in Education  
<http://www.roboteducation.org/index.html>

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*Dr. Mark Guzdial was interviewed about his assessment research by Dr. Wilhelmina Savenye on May 25, 2007.*