B ringing leading-edge technologies into the university classroom, Faculty Fellows of the Education Center on Computational Science and Engineering (ECCSE or “EdCenter”) at San Diego State University (SDSU) are pursuing projects that rely on advanced cyberinfrastructure from the San Diego Supercomputer Center (SDSC) at UC San Diego.

MAKING BEAUTIFUL MUSIC

Professor Mitzi Kolar, director of the graduate degree program in piano pedagogy at SDSU, has worked with EdCenter staff to develop the Web-based “Music Grader Administrative Tool” for evaluating students’ piano proficiencies. The tool uses SDSC’s Storage Resource Broker (SRB), a powerful data management tool, to help the instructor keep track of literally thousands of MIDI (Musical Instrument Digital Interface) sound recordings made by students.

Since the piano program is a requirement for all SDSU music majors and minors, it has an extremely high enrollment, explains Kolar. “With around 120 students taking four performance exams per semester, each exam with half a dozen parts on different musical skills like improvisation, performance, and technique, this means that we have to do four or five thousand evaluations per semester.” The challenge of tracking and grading all these performances is what led Kolar to the EdCenter, where she worked with the team to develop the first Faculty Fellow project in the fine arts.

As a result, Kolar is now using advanced technologies to make this large-scale evaluation process more feasible.

PUTTING TECHNOLOGY IN THE CLASSROOM

SDSU’s EdCenter, funded primarily by the National Science Foundation (NSF), initiated the Faculty Fellows program in 1998. The program is designed to help faculty members discover and implement applications of modern cyberinfrastructure and computational science in undergraduate curricula. The program supports up to six professors per year, providing time and expert assistance from the EdCenter’s team of educators and developers. Fellows are selected for one semester, but most continue for a full year. At the end of each semester, the Fellows present their projects to an audience that includes SDSU administrators and department chairs.

“In the first phase, university faculty learn specific options for using advanced technology in education,” said Kris Stewart, director of the EdCenter. “As the faculty get up to speed on the technology and our information technology staff collaborate with them, the educators are able to take advantage of the power of SDSC technologies in their teaching.” Not only does this benefit the faculty involved, it also demonstrates for other faculty the power and promise of advanced technologies, Stewart noted.

Jeff Sale, EdCenter staff scientist, explained that the Faculty Fellows program addresses the problem that many faculty members have no idea who to ask for help in exploring and implementing advanced technologies in undergraduate education. “The strengths of the EdCenter’s interdisciplinary approach are that it gives faculty the support they need to try our new ideas for using technology in their teaching, and at the same time provides computer science students with invaluable opportunities to gain hands-on experience as they collaborate with the faculty.”

BUILDING STUDENT CONFIDENCE

Faculty who participate in the program often find that there are benefits beyond simply increasing efficiency, and that new technologies can change education for the better. For example, traditionally piano students have taken their exams by playing pieces while the instructor listens. In addition to the scheduling limitation that requires both student and instructor to be present, it can be difficult for students with performance anxiety to have the instructor looking over their shoulder.

The new evaluation system that Kolar and the EdCenter staff have developed relies on piano labs equipped with 26 Roland digital pianos and iMac computers. Students play their pieces on the digital pianos and save their recordings using standard MIDI files, which are stored in a SDSC SRB collection as part of the EdCenter-developed Music Grader Administrative Tool, and then evaluated by the instructor.
Using the Web interface of the SRB-based Music Grader Administrative Tool, the instructor can flexibly access and display students’ evaluation MIDI files, listen to them, complete the evaluation, and generate results including individual comments, which can be printed or e-mailed to the student.

### 110 C Class Piano
Professor Mitzi Kolar

**EXAMINATION #3**

**NAME:**

**GRADE:**

**QUIZZES:**

1. **F241#14: SEVENTH CHORDS**
   - Key 1: `I`
   - Key 2: `I`
   - Comments:

2. **F241#16: SEVENTH CHORD INVERSION**
   - A7
   - D7
   - Root: `6/5`
   - `4/3`
   - `4/2`
   - Comments:

3. **F115: I-V4/2 of V6/5-V6/5-I**
   - E-flat
   - I
   - V4/2 of V6/5
   - V6/5
   - Comments:

4. **F121#9: Gay Caballero**
   - BLOCK CHORDS
   - Comments:

   - AS WRITTEN
   - Comments:

   - F Major with block chords
   - Comments:

- **Chords**
- **Beat**
- **Rhythms**
- **Melody**

- **RH**
- **LH**
- **Beat**
- **Rhythms**
- **Register**
- **Fingering**
- **Expression**

- **RH**
- **Chords**
- **Beat**
- **Rhythms**

This performance can be saved as an MIDI file, as a standard MIDI file, and can be viewed as such in a music player. Since “practice makes perfect,” they can do the evaluation several times until they get a great performance, and complete this in the “privacy” of their headphones, reducing performance jitters. Once a student has completed the evaluation to their satisfaction, they transfer the MIDI files to the instructor’s Macintosh computer.

When the files reach the instructor’s Mac, they are stored in the SRB collection, which is running under Mac OS X in the music lab. Here the evaluation files can be flexibly accessed and displayed by the instructor through the Web interface to the SRB developed by EdCenter student programmers Vahid Pazirandeh and John Nguyen. Pazirandeh commented that the SRB is versatile, running on a variety of platforms, and well documented, which helped him use the Jargon Application Program Interface (API) to customize the SRB for the Music Grader Administrative Tool.

Using the Web interface, the instructor listens to each student’s file, completes the evaluation, and generates results, including individual comments, which can then be printed or e-mailed to the student.

“We’re very pleased at the feedback from student evaluations, which show that a majority of students prefer this new method of recording their exams as MIDI files,” said Kolar. “Not only does the SRB-based Music Grader Administrative Tool relieve educators from much of the drudgery of grading so that they can spend more time on the needs of students, the students also felt that this new evaluation method reduced their stress levels and helped them provide better examples of their performance skills.”

As a result of experience gained, Kolar is planning to seek support to apply artificial intelligence tools to help extend the technology to automate grading of the more mechanical aspects of the piano pieces, such as notes, rhythm, and timing.

### SPREADING TECHNOLOGY

An interesting benefit of the Faculty Fellows program is that many participants such as Kolar are in non-science areas, so that the computer science students collaborating in these projects have to learn how to understand diverse disciplines, their goals and terminologies, in order to be able to build usable interfaces and tools. “And that’s a great lesson,” said Stewart.

The EdCenter is an Education, Outreach, and Training project established on the SDSU campus in 1997. The program is supported by grants from the NSF and grants from the SDSU Academic Affairs. EdCenter staff include Jeff Sale, staff scientist; Kirsten Barber, computer resource specialist and Oracle database administrator; Melody Hoolihan, administrative support; as well as a number of student programmers.

Stewart says she has been pleasantly surprised at how the program has attracted faculty from a diversity of colleges within and beyond the university. “Seeing these faculty from very different areas learn from each other has taught us an important lesson—working with these new technologies can help educators bridge across the disciplinary walls that often needlessly separate them.”

---

**SDSU EdCenter:**

[www.edcenter.sdsu.edu](http://www.edcenter.sdsu.edu)