Best Practices in Online Tutoring in STEM with the Deaf STEM Community Alliance Virtual Academic Community (VAC)

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Presentation Overview

- Introductions
- Project Background
- Synchronous Online Tutoring in STEM
  - Chemistry
  - Physics
  - Computer Science
- Asynchronous Online Tutoring
- Conclusions
- Q & A

Introductions

- Lisa B. Elliot, PI, Deaf STEM Community Alliance
- Austin U. Gehret, RIT/NTID Faculty
- Stacey Davis, RIT/NTID Faculty
- Raja Kushalnagar, RIT/NTID Faculty
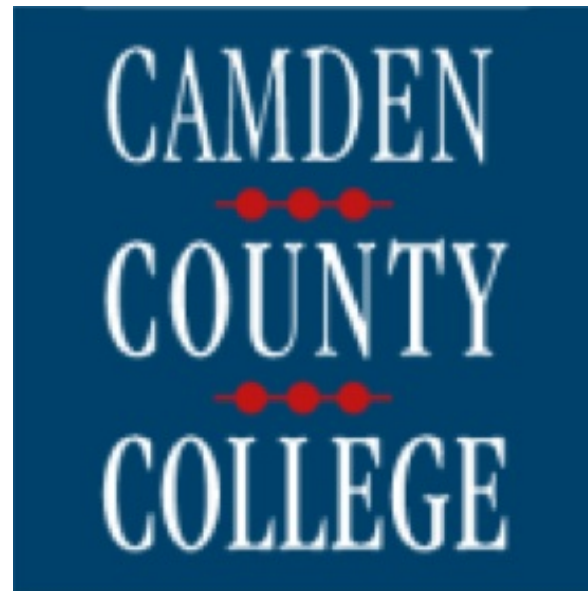- Warren Goldmann, RIT/NTID Faculty

Who We Are

- Deaf STEM Community Alliance
  - Only Alliance targeted to a single disability
- Supported by the National Science Foundation, HRD #1127955
- 3-5 year project (Sept 2011- Aug 2016)
  - Now in our 2nd year

Campus Partners

Cornell University

R·I·T

CAMDEN
COUNTY
COLLEGE

Project Rationale

- Participation gap in STEM for students who are deaf or hard of hearing (D/HH)
  - National average graduation rate for D/HH bachelor's degree: 23% (vs. 73% at RIT/NTID) (all subjects)
  - Between 1997-2006, 420 out of 265,790 (~.2%) of new STEM PhDs were D/HH
  - Employment differentials in STEM:
    - Hearing 17.9% v 15.5% D/HH
    - Hearing in higher-earning STEM sectors than D/HH

- Contributing barriers:
  - Student preparation (STEM basic skills, concepts)
  - Socialization (peers, role models)
  - Accessible media

Project Rationale

- Solution: Deaf STEM Community Alliance
  - Student preparation
    - Remote tutoring
    - Remote captioning
    - Remote interpreting
  - Socialization
    - Remote mentoring
    - Peer interaction
  - Accessible media
    - Curated collection of STEM resources

Goal and Objectives

- Goal
  - Create a *model* virtual academic community to increase the graduation rates of postsecondary D/HH STEM majors in the long term
    - Model building from a software engineering perspective
      - Incremental development (part by part)
      - Iterative development (revise & improve with lessons learned)
- Objectives
  - Document and disseminate a description of the process of creating a model VAC for replication
  - Increase the GPAs and retention rates of D/HH students in STEM majors

Remote Tutoring

- Started with traditional, face-to-face model used at NTID
  - Faculty members provide individual and small group sessions to support students outside of class (appt.-based)
  - 2011-12, RIT/NTID provided more than 14,000 hours in STEM tutoring to D/HH students registered in courses in 8 STEM-related colleges at RIT (Applied Science & Technology; Computing & Information Science; Engineering; Imaging Arts & Sciences; Science) (~500 students)

Remote Tutoring

Tutoring Models

- RIT Faculty/RIT Students: (T=6; S=12)
  - (RIT-RIT) Faculty in office, students in nearby learning center
  - (RIT-RIT) Faculty in office or other space on campus, students at home

- RIT Grad Student/Camden Students (T=1; S=2)
  - Only remote!

- RIT Off-Campus Adjunct/RIT Students (T=1; S=4)
  - Only remote!

- Cornell Student Tutor/Cornell Student (oral student) (T=1; S=1)

Synchronous Tutoring Methodology

- 1:1 tutoring sessions
- Google+ Hangouts as videoconference/chat platform
- 15 min-2 hr sessions
- Appointment-based scheduling
- Homework-oriented (vs. basic skills)
- Macs, PCs, desktops, laptops, Chromebooks

Synchronous Tutoring Chemistry – Austin U. Gehret

- 5 students tutored-4 courses
  - Biochemistry: Nucleic Acids
  - Biochemistry: Conformation & Dynamics
  - Biochemistry: Metabolism
  - General & Analytical Chemistry III
- Tools used
  - iMac (built-in iSight camera) and wired internet connectivity
  - whiteboard
  - Shared .pdf files
  - Google+ Hangouts screenshare option
- What communication strategies used?
  - Signing
  - Chat

Synchronous Tutoring Chemistry – Austin U. Gehret

- What makes remote tutoring different than face-to-face tutoring?
  - Greater need for clear communication
  - Different ways of presenting material
- Advantages/Benefits of remote tutoring?
  - Good tool for sharing documents
  - Easy to search & highlight key phrases with student
  - Good for observing students' homework and watching for mistakes, providing faster feedback
  - Good for classes with heavy online component
  - Better accommodation to student schedules
- Challenges—AND HOW WERE THEY ADDRESSED OR SOLVED?
  - Need for digital whiteboard tool: used regular whiteboard
- Ideal student
  - Flexible communication style

Synchronous Tutoring Physics – Stacey Davis

- 3 students tutored
  - College Physics
  - University Physics
- Communication strategies—matched with student
  - Chat
  - Voice
  - Sign
- Tools used (e.g., whiteboard, chat, models, online references)?
  - Chat
  - Document share
  - Paper, pencil & camera

Synchronous Tutoring
Physics – Stacey Davis

- What makes remote tutoring different than face-to-face tutoring?
  - Easier access to tutoring when it's needed
- Advantages/Benefits of remote tutoring?
  - Easier access to online homework for students and tutors
  - Easier to accommodate to student schedules
  - Easy to meet with multiple students at the same time
  - Good for "after hour" "on demand" homework questions
- Challenges—AND HOW WERE THEY ADDRESSED OR SOLVED
  - Hard to use mouse for drawing: paper & pencil + camera
  - Unannounced changes in Google+ interface: technical assistance from VAC manager
- Ideal student
  - Technically adept
  - Strong reading & math skills

Synchronous/Asynchronous Tutoring Computer Science – Raja Kushalnagar

- 3 students tutored
  - Courses:
    - CS 2 (Python) Intro to C++, Perl Scripting
- Communication strategies used:
  - Synchronous: Hangouts Video & Chat
  - Asynchronous: Email & VP messages
- What tools used (e.g., whiteboard, chat, models, online references)?
  - Chat, Google App Share

Synchronous/Asynchronous Tutoring Computer Science – Raja Kushalnagar

- What makes remote tutoring different than face-to-face tutoring?
  - Pros: Can tutor from anywhere
  - Cons: Much harder to share visual space (3D is not possible now), eye-contact and turn taking has to be modified)
- Advantages/Benefits of remote tutoring?
  - Synchronous
    - Conversational tutoring (test preparation)
    - Group tutoring (test review)
    - Flexibility for travel (without time differences)
  - Asynchronous
    - Flexibility for travel (with time differences)
- Challenges—AND HOW WERE THEY ADDRESSED OR SOLVED
  - Sharing programming applications
- Ideal student
  - Student who can adapt to 2D and to absence of eye-contact in turns.

Asynchronous Tutoring
Mathematics – Warren Goldmann

- Rationale: Difficult to schedule students during traditional tutoring hours; provide additional feedback after session concluded
- 4 Students tutored
  - Multivariable calculus
  - Differential equations
  - Data analysis
  - Calculus
- Tools used:
  - Email
  - Photos (originating from either tutor or student)
  - Informational handouts
  - Diagrams
  - Shared documents

Asynchronous Tutoring Mathematics – Warren Goldmann

- What makes remote tutoring different than face-to-face tutoring?
  - Can give more elaborated responses
- Advantages/Benefits of remote tutoring?
  - Flexible scheduling
  - Documents can be shared with other students
  - Allows students to formulate questions at their own pace
- Challenges—AND HOW WERE THEY ADDRESSED OR SOLVED
  - Helping student to problem-solve: Have access to materials and tools online that can be shared
- Ideal student
  - Know the right questions to ask
  - Well-prepared with appropriate reference materials available

Conclusions

- Remote tutoring can be used with a variety of STEM courses
- Remote tutoring using Google+ Hangouts can be used with students with diverse communication preferences
- As more resources and course materials go online, using remote tutoring becomes a good solution for shared access to materials
- Remote tutoring addresses needs for accommodating student schedules
- Remote tutoring for STEM courses is a work in progress, constantly evolving with changing technologies

Q & A

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