Online Tutoring for Deaf and Hard of Hearing Students: Creating Resources Across Time & Space

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Abstract— This poster describes *synchronous* and *asynchronous* online tutoring resources for courses in science, technology, engineering, and math (STEM). The resources are sponsored by the Deaf STEM Community Alliance, funded by the National Science Foundation, and offered to DHH student participants at RIT, Camden County College, and Cornell University. The alliance has been offering synchronous online tutoring since 2012. Included in the poster are preliminary results of a qualitative analysis of video content from a subsample of the synchronous tutoring sessions. This study is being conducted to understand what transpires during synchronous tutoring sessions with regard to communication strategies, conversation content, materials used, and technology issues. While literature on online learning suggests that faculty members are reluctant to get involved often due to concerns about technology issues, our research suggests that technical difficulties have only occurred occasionally, and the majority of interactions focus on course content. In addition to synchronous resources, asynchronous resources are valuable when synchronous sessions are impractical. One example of asynchronous resources are videos created by an alliance tutor to support student learning. Results from a study of user analytics of these videos suggest that students are utilizing the video resources. These results suggest that in addition to synchronous resources, asynchronous resources can be valuable when interpersonal resources are unavailable.

Keywords—synchronous online tutoring; asynchronous online tutoring; deaf and hard of students

Introduction (*Heading 1*)

Online support for academic subjects is widely available for the general postsecondary student population in both asynchronous formats (e.g., [1]) and synchronous systems (e.g., [2]; [3]; [4]). Academic support is especially valuable for postsecondary students who are deaf or hard of hearing because many of these students arrive at college or university underprepared for their coursework [5]; [6]. However, many of the generic resources are not accessible for students who are deaf or hard of hearing (DHH) because generic online resources do not match DHH students' communication preferences or address other academic needs.

Until recently, most research on online tutoring pertained to satisfaction studies [7]. Studies of what actually happens during tutoring sessions are much less common (e.g., [8]). Ubell [9] has noted that despite students' use and enthusiasm for online learning, faculty are still reluctant to embrace it in part because of concerns for the need to exhibit technical expertise [8]; [10].

Synchronous tutoring is not always available, particularly because of student/tutor scheduling conflicts or because a tutor may not be available with the requisite communication and content skills [11]. Additionally, mainstream videos explaining STEM concepts tend not to include ASL [12]. Mathematics is one academic area in which DHH students often struggle, and is a barrier to future success in STEM [13]. In order to provide additional resources for students for test preparation, one tutor associated with the alliance has been preparing short videos that explain the procedure for solving math problems that have been assigned for several basic math courses. This paper reports on the user analytics for a set of videos stored on the alliance's YouTube channel.

In addition to limited student preparation, DHH students interested in STEM fields often experience social isolation and less exposure to accessible STEM information. The Deaf STEM Community Alliance, funded by the National Science Foundation, was created to address these barriers. The alliance includes student, faculty and staff participants at Rochester Institute of Technology (RIT), Camden County College (Blackwood, NJ), and Cornell University (Ithaca, NY), as well as DHH professionals in STEM fields who reside across the US. Activities supported by the alliance include online tutoring, a mentoring network, and a community that shares accessible information about STEM topics.

Data generated by alliance activities provide the basis for the studies presented it this poster session. These studies offer: 1) an opportunity to unveil what does occur during synchronous online tutoring sessions with DHH students and 2) explore another online resource that can be helpful for DHH students.

Synchronous Tutoring Study

A. Study Overview

From February 2012 through the present, the Deaf STEM Community Alliance has facilitated online, synchronous tutoring for student participants. To date, students and their tutors have completed 160 tutoring sessions. Thirty-two (20%) of the sessions have been captured on video and are being

analyzed for a qualitative study of the content of online tutoring sessions. The sessions pertain to postsecondary courses in science, technology, engineering and mathematics (STEM). This paper presents preliminary data of the ongoing analysis, including eight of the 32 videos that will be analyzed.

B. Participants

Sixteen tutors and 34 students have received tutoring. The tutors are either faculty members or graduate students who possess both content and communication competency. The students are undergraduates at the community college (Camden) or university level (RIT and Cornell). For the current study, video data from three tutors and three students are included.

C. Materials and Procedure

Among the 160 tutoring sessions, sessions range in length between 15 minutes and 3 hours. The average session is 63 minutes long. Sessions took place online using the Google Hangouts video conferencing platform [14] and were accessed using Macs, PCs, Chromebooks, iPads, and smart phones. Typically, tutors held sessions from their campus offices, while students were working from a campus learning center, dormitory room, or home. Sessions took place during weekdays, weeknights, and on weekends. On average, tutors received about 1 hour of training prior to beginning tutoring, while students often felt comfortable with 30 minutes of training.

D. Data

For the current study, excerpts of a sample of sessions are used. The sessions were recorded using a variety of tools such as external video recording equipment, iPhones, and computer software such as Camtasia. The video excerpts varied in length between 30 seconds-3.5 minutes. The courses included Biochemistry, Mathematics, and Physics.

E. Analysis

The videos are being analyzed by a research team that includes both students and tutors. The qualitative coding scheme was adapted from Bryant [8]. Coders review the videos individually and then meet regularly to discuss their codes. Final coding is determined by consensus.

Codes are organized according to four main thematic groups: communication style; conversation content; materials used; and, technology issues.

F. Results

Eight videos have been coded thus far, representing approximately 20% of all the video excerpts. To date, the analysis has shown the following trends:

- *Communication style*: Students used Simultaneous Communication (American Sign Language (ASL) and Spoken Language) most often, followed by ASL only. Tutors used ASL, facial expression without ASL, or spoken language with similar frequency.
- *Conversation content*: For both students and tutors, the primary conversation content focuses on providing information or expressing understanding about the topic being discussed.
- *Materials used:* While tutoring may utilize a wide variety of materials such as handouts, photos, and online resources, the sessions analyzed thus far have predominantly used hardcopy homework documents. Students have also used text-based chat to discuss tutoring issues. On occasion, sessions also used online materials.
- *Technology issues:*The videos analyzed thus far have included very few technology issues. Two students experienced an issue, while none of the tutors experienced issues. In one instance, a tutor provided a student with some technical instruction.

G. Conclusions

While the literature on online learning suggests that faculty members may be reluctant to pursue online options with their students due to technology concerns, this preliminary analysis of recorded synchronous tutoring sessions does not demonstrate that technology problems are a frequent occurrence. Of course, the technology issue theme may occur in future videos. Furthermore, analysis of conversation content demonstrated that the bulk of conversation pertained to sharing information or expressing understanding of course content issues, compared to discussing issues pertaining to operating the technology. Students and tutors relied on multiple channels of communication, including Simultaneous communication, ASL, facial expressions and text-based chat conversations. The use of varied communication strategies suggests that a video communication platform for online tutoring for DHH students is desirable. Continued analysis of the video samples is planned and conclusions may change over time.

II. Asynchronous Resources

In order to provide additional resources for students for test preparation, one tutor associated with the alliance has been preparing short videos that explain the procedure for solving math problems that have been assigned for several basic math courses. This paper reports on the user analytics for a set of videos stored on the alliance's YouTube channel.

A. Materials and Procedures

One faculty member who participates in the alliance created a series of videos for student use. The videos were recorded on a standard computer and edited with Camtasia software [15]. The videos are archived on the alliance's YouTube channel (http://youtube.com/users/dhhvac). Videos include audio, ASL, and a visual whiteboard display of problems that are being solved One hundred and thirty-one

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videos, representing four chapters were produced and viewed in the Fall of 2016. The library expanded to 166 videos during the current, 2017 Spring semester. The shortest video is 27 seconds long, and the longest video is 9:14. Among the videos produced during the Fall 2016 semester, the average length was 2:42. With the additional videos produced during the Spring 2017 semester, the average length decreased to 2:29.

B. Results

User analytics have been created with the analytics tool on the alliance's YouTube channel. Select user analytics for the videos are displayed in Table 1.

TABLE 1. User Analytics

Metric	Fall 2016	Spring 2017 (to date)
Number of Videos	131	166
Total Views	1930	855
Total Watchtime (Minutes)	2463	1075
Average Watchtime (Minutes)	12:06	11:02

C. Conclusions

One faculty member created brief videos of math problems for her students to help them prepare for exams. At the time that the initial videos were created, it was uncertain as to whether students would actually watch the videos. As demonstrated by the user analytics, the students did watch the videos. Anecdotal information from the instructor suggests that students were happy with the videos and that unlike previous semesters in which students needed a great deal of test preparation, students who watched the videos appeared to be more confident coming into the test situation. Providing brief videos of course material appears to be a useful addition to support students for these mathematics classes.

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