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Elements of Successful Support and Access Services for STEM Students Who are Deaf and Hard of Hearing

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ELEMENTS OF SUCCESSFUL SUPPORT AND ACCESS SERVICES FOR STEM STUDENTS WHO ARE DEAF OR HARD OF HEARING

Introduction

During the past 30 years several studies, including two major reports from the Federal Government, have documented the poor and declining performance of the United States students in science and technology education. This decline is a special concern because it is science and technology that propelled most of the increase in US per capita income in the past century, and the US is rapidly losing its position as a world leader in science and technology.

Twenty-five years ago the National Academy of Sciences released a report entitled: *A Nation at Risk: the Imperative for Educational Reform, which highlighted concern about America's educational system, particularly in the area of STEM education* (1). Recently, the President's Council of Advisors on Science and Technology (PCAST) presented the President with a report titled: *Prepare and Inspire: K-12 Education in Science, Technology, Engineering and Math (STEM) Education for America's Future* (2). This report outlines steps necessary to improve the science education of in K-12 and by implication, in postsecondary education. The report has the full approval of the President and bipartisan support in Congress.

Although these reports present a rigorous and in-depth plan for enhancing STEM education, both reports leave a number of our young people out of the picture. The authors state that the recommendations of the reports should include all students and provide all students with the opportunity to enter and exceed in STEM programs. However, the reports virtually ignore students with disabilities mentioning them only twice, and never mentioning students who are deaf or hard of hearing (D/HOH). Despite their best intentions the reports appear to continue the marginalization of students with disabilities in general and of D/HoH students in particular. This omission is not intentional, but reflects the general attitude concerning D/HoH students across a broad spectrum of education, adding one more significant barrier from that prevents D/HoH students from fully participating in and contributing to improving science and technology in the US.

Hearing loss may be invisible to the general public, but it is a very significant barrier to preparing for STEM careers. This results in the very real concern about a ‘participation gap’ raised for students who can be educationally marginalized because their modes of communication and learning styles are different from their hearing peers (3). We must address

the needs of these students to ensure that, in this digital age, every deaf or hard-of-hearing individual, who has the talent and desire to pursue educational opportunities in STEM fields, will have available to them a fully inclusive environment that will support full access, regardless of their communication modalities, anytime, anywhere. Failure to do so will result in the loss of a significant cadre of potential STEM students through attrition in formal education because the barriers can be too daunting for many of the D/HOH learners. The number of deaf and hard of hearing students currently enrolled in K-12 education is estimated to be approximately 341,000 children between the ages of 6 and 18 (5). The number in postsecondary STEM programs nationally is not known with certainty, but approximately 50,000 students is a reasonable estimate (4,5,6).

Goals and Barriers to Success in STEM

The goals of recent NTID projects focusing on remote academic and communication support for deaf STEM college students, funded by the National Science Foundation (7, 8) are: 1. To increase the number of students who are deaf or hard of hearing participating in postsecondary STEM programs; 2. Significantly increase student retention and graduation rates from STEM programs and 3. Foster the transition to graduate school and/or careers in STEM professions. Historically, deaf and hard of hearing students have faced significant barriers in excelling in secondary education and particularly at the postsecondary level. Replacing these barriers with positive and effective practices will support students in achieving their full potential. In other words, barriers must be replaced by best practices in education for D/HoH students. A major benefit of this approach will be to increase the number of students participating in postsecondary STEM programs, significantly increase student retention and graduation rates from these programs, and foster the transition to graduate school and careers in STEM professions. The elimination of barriers, both in formal and informal educational settings will be critical for achieving these goals.

The barriers confronting students who are D/HoH and preventing them from integrating within the STEM learning community are well known. These barriers include, but are not limited to:

1. Lack of effective access to information and support services at many postsecondary institutions across the country;
2. Isolation from the learning and social environment within the hearing community preventing their integration into the total educational environment;

3. Marginalization and isolation within the educational community and environment of students and faculty as a result of their differing communication needs;
4. Lack of, or inadequate academic preparation in prior school experiences which leaves the students academically behind less self confident than their hearing peers;
5. Appropriate language and literacy skills;
6. Lack of appropriate STEM role models in the D/HoH community.

The RIT/NTID Model: Support and Access Services

Success of the NTID Model

The average graduation of D/HoH students in postsecondary education is approximately 35% at the BS level. At RIT, the graduation rate is 63% or above; first-year retention rate is 83% of supported BS level students. A very successful program developed by NTID for entering students with weaker academic skills than their hearing peers, the pre-baccalaureate program, has achieved a retention rate of 73% and of those students accepted into RIT BS programs after completing this one year program, the graduation rate is 84% (9).

This success rate, accomplished in the light of the fact that D/HoH generally come to RIT with lower skills than their hearing peers, can be attributed to the model of support and access services that RIT/NTID provides. These services are: faculty tutoring, advising, mentoring, liaison interactions with RIT faculty, personal counseling, excellent and comprehensive access services which include interpreting, notetaking and c-print. It is doubtful this model could be duplicated at other postsecondary institutions because of the high costs. For this reason we want to "export" the model to other colleges and universities using cyberinfrastructure technologies to support remotely D/HoH students in STEM programs.

Roles of Support Faculty

There are at least three primary roles played by the faculty that contribute to the ability of students who are deaf or hard of hearing to achieve success in the various mainstreamed programs at RIT. The roles, defined below, are: tutoring, advising/mentoring, and liaison work.

Faculty tutoring. The responsibility of helping students to both master the course material and internalize strategies for becoming independent learners are identical to the goals of the classroom teacher. However, the ability to work with students either one-on-one or in small groups, allows the tutor to address the individual learning needs of each student. As experts in the discipline, support faculty are able to clarify and expand the classroom experience for the

student, which includes review of classroom notes, the amplification and/or clarification of difficult concepts, and suggestions for additional study strategies. Support faculty also design and develop materials such as visual representations of conceptual information, study guides, practice tests, per-laboratory instruction, and writing revision techniques. They do all this in response to course materials developed by other (RIT) faculty members. In their role as tutor, they are expected to stay current with the rapid advances in their areas of support.

The benefits provided to D/HoH students by tutors are:

1. Provide a unique service that is extremely attractive to students, and draws them to RIT.
2. Provide a continuity of interaction that helps students develop learning strategies that lead them to become independent learners and develop critical thinking skills.
3. Can be available at the student's convenience, not the other way around.
4. Have access to equipment, labs, resources of which students can take advantage.
5. Can bring their expertise in sign language, deaf culture, course content, career choices, and success strategies to a tutoring session.
6. Have a broad knowledge of the teaching styles of the RIT faculty.
7. Have a broad knowledge in specialized areas, as well as knowledge across related disciplines that add to their ability to tutor students.
8. Can provide assistance with study skills, test taking skills, along with content expertise.

Advising/Mentoring Role. The Support Department model is unique in that it places career and content knowledgeable faculty in an advising and mentoring role with deaf students. Over many years, together with the instructional role, the advising role has developed and become a cornerstone of the intervention strategies utilized with D/HoH students. In performing their advising/mentoring role, support faculty have made significant contributions to the high level of achievement of deaf students in baccalaureate and graduate programs at RIT. This achievement has been recognized by the National Science Foundation by the awarding of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring to the Science and Engineering Support Department at NTID.

The list below provides details on the role support department faculty advisors perform:

1. Support Department faculty is successful advisors/mentors because they can combine their career and content expertise with the ability to communicate easily and effectively with students.
2. Support faculty members bring to their advising role an in-depth knowledge of deaf culture and the special learning needs associated with deaf students mainstreamed into a classroom comprised mostly of hearing students.
3. Possessing the same or similar academic credential to which the student aspires as well as having "real world experience" allows the mentor to draw upon this background to confidently assist the student through the various stages of academic development.
4. Since advisors typically interact with the student in a variety of instructional ways, the mentoring nature of the relationship is enhanced, lending it confidence and credibility
5. The singular manner in which these services are provided not only results in the high success rate enjoyed by deaf students, but it also is a particularly important recruitment tool.

Liaison Role. The liaison role augments the professional tutoring role. Interactions with faculty and staff of the college supported make it possible for students to get transfer credit information, seek help from the bursar or registrar, get appropriate accommodations from Special Services, get assistance with coop placement, apply to graduate school. The liaison work helps RIT faculty overcome any misperceptions they may have about deaf students in their classes, helps students resolve problems with a minimum of effort and frustration.

In their liaison capacity, support faculty:

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1. Have the credibility required to advocate for the student and liaison successfully because they are credentialed in the same content area as the RIT faculty members in the student's department.
2. Are aware of developments within the departments, such as curriculum changes, advances in technology and its applications, and changes in personnel by attending department/college meetings, spending time with individual faculty, serving on committees, and/or conferring with faculty advisors.

3. Act as advocates for students by serving as "educators" for other RIT faculty, providing basic information and promoting sensitivity to deafness and its related issues.
4. Work collaboratively with the members of other NTID departments, particularly English and mathematics, to help students make the transition between NTID courses and those in the other colleges of RIT.

Organization Support Departments

The faculty who support D/HoH students are organized into departments based on the disciplines they are supporting and housed in the college they are supporting. All support faculty have at least MS degrees in the discipline they are supporting and many of them have Ph.D. in the discipline. They are considered colleagues by the RIT instructional faculty and are critical for their ability to work effectively with students who are deaf or hard of hearing. As a result of this arrangement, the support departments serve as a community of learners or a social network for the students in these areas. Students feel very comfortable dropping into the support departments for informal interactions with faculty, staff and other students. This provides a place for students to exchange ideas with other students, ask questions of the faculty and develop their own learning community, so to speak, and generally have a supportive and welcoming environment. This is very important for the students to become integrated within the educational environment at the greater University and develop the confidence and information that they will need to carry them through the undergraduate program in STEM fields. This is particularly important during their first two years in a STEM major. It is our goal to establish a virtual "support department" or community of learners of D/HoH students at other colleges and universities using the cyberinfrastructure approach, an academic and career oriented social network.

Access Services. Access services consist of three types of services: interpreting services, C-print services, and notetaking services. These services are absolutely necessary for students who are deaf or hard of hearing to succeed in these rigorous programs, since they provide access to the information, instruction and communication in the classroom, and access to all campus activities outside of the classroom. These services also allow students to integrate within all activities of the educational environment.

Interpreting services and notetaking services are organized into core teams. Each core team is associated with a specific academic areas and non- academic areas. For example, there is a core team for liberal arts, there is a core team for computer related disciplines and there is a

core team for science and engineering. This allows the interpreters to develop an understanding of the disciplines they are interpreting for and to develop a fluency and facility in interpreting that discipline, providing more clarity and accuracy to their assignments in the classroom and outside of the classroom. Because they are familiar, and in some cases trained in the disciplines that they are interpreting, they understand the concepts that are being taught in the classroom and therefore can provide more accurate and meaningful interpreting.

The notetakers that are assigned to these courses are also, when possible, students in the majors for which they are providing notetaking services. Clearly, this is a major positive factor in providing accurate and understandable notes for the students to use after the class for review and studying the material.

C- print captionists provide real time captioning and transcript of the lectures. The transcripts are available for student use on a secure web site. The students receive real-time text display of the lecture on their laptops and within two hours will have their copy of the transcript for reviewing and studying the material sent to a secure web site.

Students have a choice of which access service they will use, either an interpreter and a notetaker, or c-print services.

Ethical and Copyright Issues Related to Such Services

To our way of thinking there does not appear to be significant ethical issues associated with this approach to providing access and support for deaf and hard of hearing students in STEM fields. However, there would be an ethical issue if students were denied these services and were unable to fully participate in the educational environment.

Copyright issues could arise for faculty members related to disbursing classroom notes or lecture transcripts to the students by way of the internet. This issue has been reviewed at RIT and found not to pose a copyright problem. The use of media and captioning of media for use by students who are deaf or hard of hearing will follow the guidelines already established by the host institution.

Conclusion

We are well aware of the fact that we cannot duplicate exactly the model used to deliver support and accesses to D/HoH students at RIT/NTID through virtual cyberinfrastructure technology. But we believe that we can effectively provide D/HoH students an accessible educational environment remotely and establish a virtual community of learners which is interactive and supportive of D/HoH students in the STEM fields at other colleges and

universities. And at some future time, expand this approach to support D/HoH students at the secondary level, especially students who may live in rural or isolated areas, so they will be better prepared to successfully take on a rigorous STEM program at the postsecondary level.

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