Title: **Developing Students' Diagnostic Abilities in a Hearing Disorders Course**
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Summary: A Speech-Language-Hearing professor describes the changes she made to a graduate-level course on hearing disorders in order to help students develop the problem-solving and evaluation skills needed to properly diagnosis audiology disorders.

Background Information

Students working toward the Doctor of Audiology (Au.D.) degree at KU are required to enroll in AUD 811, a course entitled Hearing Disorders. The course is typically taken by six to ten students in their second semester of a four-year graduate program. The course is designed to provide students with an understanding of a broad range of disorders affecting the human auditory system and to prepare them to work in a diagnostic role. The disorders are approached from both an audiology and a medical perspective.

The primary goals for this class are for the students to:

- Develop the skills necessary to identify and diagnose hearing disorders in the clinic, and
- Develop sufficient comfort with medical aspects of hearing loss so that they can interact with physicians on a professional level.

My current teaching inquiry is based on numerous observations I made after teaching the course for the first time in Spring 2007. These observations generally fall into two categories:

First, while a major goal of the course was to develop diagnostic audiology skills, very little class time was devoted to working on this skill. Instead, a significant portion of class time was spent describing signs and symptoms along with medical diagnostic and treatment options. It was suggested that the students practice diagnostic audiology skills by independently working through clinical case examples on a departmentally owned CD that had been developed by the American Academy of Audiology (AAA). No course requirements were directly tied to completing the exercises on this CD. Students continued to make errors in this area on the final exam, and I felt limited in my ability to ask these types of questions on the exams because there had been so little emphasis on it in lecture.

Second, I was extremely dissatisfied with the outcome of one of the major assignments during the course, the presentations that students gave over audiology disorders. The students were assigned three unique disorders to research and then present in class; they were also required to write a research paper on one of the three disorders. The disorders assigned to the students were key course material and, therefore, the contents of the presentations were covered on the exams. Although the students reported that they learned a great deal from researching and presenting a disorder, the quality, completeness, and accuracy of these presentations varied from student to student and from disorder to disorder. My rubric for grading the presentation was poorly conceptualized, making grading of these presentations difficult and subjective. Furthermore, I found it very difficult to tactfully interject missing information or correct errors during these presentations. The difficulty in correcting information during the presentations arose because I

had not sufficiently defined for myself what I considered key information, particularly as it related to the diagnosis of each disorder.

Implementation

For the second offering of the course, in Spring 2008, I wanted to address the concerns that were raised in my previous course offering. I initially thought that I wanted to focus on improving the student presentation component of my class. However, I think my dissatisfaction with the student presentations was really related to the bigger issue of not structuring the class so that time could be spent developing the skills outlined in the course goals. In evaluating the Spring 2007 class performance on the final exam, it was clear that students were not transferring information regarding diagnostics to the disorders we had discussed. This was also apparent in the student presentations – they usually included diagnostic information in their presentations but often at a cursory level and with variable quality across students. Therefore, in the most recent offering of the course, I wanted to re-align the emphasis of the course to focus on diagnostic audiology and the development of these skills, with the medical information serving as a support rather than the focus.

To do this, I made the following changes to my course:

1. I used the American Academy of Audiology (AAA) CD in class as a way to work on case examples as a group. This was intended to re-align the focus of the course onto the goal of developing diagnostic skills. The AAA CD contains case examples for the majority of the disorders covered in this class. The examples on the CD are particularly useful for teaching purposes, because they are drawn from real cases and often contain shades of gray in the test results and in the interpretation. The ambiguity is representative of the way in which real cases are present in the clinic. My goal in using the CD as a group exercise was to give the students practice making diagnostic decisions as well as practice generating interpretations and recommendations. A second goal was to use it as a means to generate discussion regarding ways to approach different cases.

The CD is structured such that basic demographic information and a case history are provided for each case. Results for a wide variety of tests are also provided, some that are critical for the diagnosis of the disorder and others that are extraneous. In working through a case on the CD, the users choose which test results to examine (as if they were deciding which tests to complete in a real clinical situation) and are asked to generate an interpretation of the case and recommendations regarding the case. After they have completed the interpretation and recommendations, their test choices, interpretations, and recommendations are compared to those made by expert audiologists.

When working through the cases as a group in class, I hid the disorder type from the students, as individual users of the CD would know the disorder from the outset because the cases are identified by disorder, and I read the demographic and case history information to the group. As a group, we then decided which test results to look at and in what order. In examining the test results, we discussed how each test adds to the diagnosis of the case, how the results are interpreted, and formed a diagnosis of the most likely disorder and the recommendations to be

made at this point. We then compared our performance with the expert audiologist. We often looked at test results that were not considered critical to the diagnosis so that we could see what the expected results would be and could discuss why they did not contribute to the diagnostic process for that case/disorder.

2. I added an assignment where students were required to write a clinic report for example cases from the AAA CD that had not been covered by the group in class. Students were assigned two clinic reports over the course of the semester. In this assignment, the class was assigned a disorder that had been covered in lecture but had not been discussed as a case in class. In the assignment, all of the demographic and case history information was posted to the course Blackboard site along with all of the test results that were available on the CD for the case. The students were asked to write a clinic report that summarized the relevant case history information, described results for only those tests that were critical to the diagnosis, and contained interpretations and recommendations. Students were free to work together in determining appropriate test selection and recommendations but were required to write their own report to hand in for grading.

My goals for this assignment were similar to those for the discussion of cases in class, namely to provide the students practice with the diagnostic process. In this assignment, however, they had to work through the cases and make decisions without the benefit of immediate feedback from me. An additional goal was to provide the students with practice in writing reports, a task that they would be asked to complete during the practicum placements that began during the summer after taking this course.

3. I eliminated the student disorder presentations. Instead, each student was assigned two disorders on which they should write a brief (three to five page) research paper. These papers were compiled into a class "book" that was then made available to all students in the class at the end of the course. My goals for this assignment were to provide the students with practice reading audiology and medical texts and primary references, in order to generate a summary of a disorder from both an audiology and a medical perspective. Students were assigned two papers to give them an opportunity to learn about more than one disorder and so that they could transfer the knowledge gained from my feedback on the first paper to their preparation of the second paper. I hoped that in writing the two papers, one of the positive aspects of the presentations would be preserved; specifically, I hoped that the students would gain in-depth knowledge about their disorders. Also, because no single textbook provides current audiologic *and* medical information for the disorders covered in the class, I hoped that the compilation "book" would be a useful reference for them in the future.

4. I developed a rubric for grading the clinic reports and research papers. The clinic report was a new assignment in Spring 2008; however, to facilitate the grading I developed a rubric. This rubric emphasized various skill areas. Students were assigned points related to their writing style and the accuracy with which they completed sections of the audiogram (a graphical representation of audiologic test results). The majority of the points, however, related to the accuracy with which they identified and described important history information, selected and correctly interpreted diagnostic test procedures, and generated clear and appropriate

recommendations. Variable points were assigned in each category to differentiate varying levels of performance across the different areas.

The rubric for the research paper was modeled on the skeleton rubric that had been provided to the students for the presentation assignment the previous year. The 2007 skeleton rubric was expanded to include points related to content and form. Within the content and form sections there were several categories, each of which was scored on a variable point scale to capture varying levels of performance in each area. I wanted to emphasize the content of the papers over the form of the papers and, therefore, assigned more points to the content areas. Because I wanted students to provide audiologic information in addition to medical (otologic) information, two sections were included that specifically asked for audiology information. These were the symptoms section, where students were asked to describe a variety of hearing and auditory symptoms, and the audiologic characteristics section, where the students were asked to describe characteristic results on a range of diagnostic tests. Both rubrics were posted on Blackboard prior to the due-date for each assignment so that the students would have a clear idea regarding how these assignments would be graded.

Student Work

Student Work from 2007 Course Offering

2007 Disorder Presentations

Across the three student presentations on unique disorders in the Spring 2007 class, there was very little variability in terms of resulting grades. The average grade was a 95% on all three presentations, and no student earned lower than a 90%. However, while not demonstrated by the grade distribution, there was variable performance in student understanding. The types of variation that I observed are described below.

An example of relatively high-level work is this student's presentation on cytomegalovirus (CMV). The strengths of this presentation are in the clarity with which the material is presented, particularly the clear description of the different types of the disease, and in the comprehensive coverage of the topic. The majority of the presentation covers medical issues surrounding CMV; however, the treatment of the audiologic aspects is correct and complete. This presentation does a good job of highlighting the highly variable test results and outcomes seen with this disease. Furthermore, the case example highlights one of the primary auditory concerns with congenital CMV, the possibility of a late onset hearing loss that will be missed in universal newborn hearing screening programs. It is difficult to identify particular weaknesses with this presentation. Although the student was assigned a grade of 98%, I now find this decision difficult to justify. This illustrates one difficulty I had with the presentation assignment. I had not adequately developed my rubric for grading the presentations, which made objective and defensible grading difficult.

In contrast to the cytomegalovirus student presentation, this student's presentation on Bell's palsy represents one where several significant weaknesses exist. The strengths of this presentation were in the description of the demographic characteristics associated with the disorder and in the description of the signs and symptoms of the disorder. This student also gave

a highly engaging presentation where the possibility of the Mona Lisa exhibiting symptoms of Bell's palsy was presented in addition to a video clip for a patient with confirmed Bell's palsy. These details gave students a clear visual image of the physical effects of the disease. The primary weakness of this presentation was in the information regarding the diagnostic tests for this disease. There were several problem areas here. These included a lack of a clear description of the range and pattern of results that are expected during acoustic reflex testing, a common audiologic test that exhibits a distinctive pattern in this disorder. The presentation also included some incorrect and incomplete information regarding some of the other tests that are used in the diagnosis and did not describe the grading scale that is widely used by medical professionals in the diagnosis of the disease. Some key details regarding treatment options were also omitted. While I was able to interject some of this information during the presentation, the limitations in this presentation had a potentially negative impact on her fellow classmates' understanding of the disorder. Of primary concern to me is that the student seems to be having difficulty identifying some of the key diagnostic information that would contribute to the diagnosis of the disease. While other students were more able to highlight this type of detail in their presentations, this student's performance exemplifies one concern I had about the course as a whole. Specifically, I had failed to adequately address the diagnostic audiology results necessary to diagnose many of the disorders. My lack of a well-defined grading rubric made it difficult to grade the presentation.

2007 Examinations
Students completed two unit exams and one final exam in the course. The grade breakdown was as follows:
Exam 1: 1 C, 4 Bs, 2 As
Exam 2: 1 B, 6 As
Final Exam: 3 Bs, 4 As

The exam that I chose to include in the portfolio demonstrates a pattern of errors I saw across many of the other students' exams in my 2007 offering of the course. For this student, most errors involved the application of diagnostic audiology techniques to the differential diagnosis of a range of disorders. This student seemed to have particular difficulty with acoustic reflex testing (an area of difficulty for many students). During the semester prior to taking my class, students took a class specifically devoted to diagnostic testing. However, it is clear that students continue to need practice applying the various tests to the specific diagnosis of a range of disorders. This pattern of errors could probably have been predicted from the relatively small amount of class time devoted to developing the students' diagnostic skills.

An additional area of concern regarding this exam and the other exams in the class is that I felt limited in the disorders for which I could ask detailed diagnostic questions. This stems from the problems associated with the student presentations. Many of the student presentations had limitations in how well they had addressed the diagnosis of the disorders, which resulted in me being unable to probe deeply into the students' understanding of these disorders.

Student Work from the 2008 Course Offering:
2008 Clinical Case Analyses

Overall, students did relatively well on the clinical report papers, and performance was slightly enhanced between Clinic Report 1 (average grade = 88%) and Clinic Report 2 (average grade = 92%). In particular, the range of scores for Clinic Report 1 (77% - 97%) was much greater than the range of scores for Clinic Report 2 (87%-95%). Some examples of student work on the two case reports are presented below.

Clinical Case 1 report: Student A. This represents relatively high-level work in describing and interpreting the case information. Student A has included all of the relevant history information for this case. The description of the test results indicates that she has recognized which tests are most critical for this case. Furthermore, for the majority of the tests, Student A correctly describes and interprets the results. The errors that exist in the interpretation of the results indicate that s/he understands the basic premise of the tests but that some confusion remains regarding details of the interpretation of the middle-ear tests. The major weakness of the report is in the recommendations section. Some of the errors that Student A made in this section are a result of errors made in interpreting the middle-ear results. Making appropriate recommendations is a relatively high-level skill and is something with which beginning students typically need assistance.

Clinical Case 1 report: Student B. This represents lower-level work than that seen in Student A's report for the same case. Here, Student B has included the most important details of the case history information but has omitted some of the less import information that, while not critical to the diagnosis, should be documented in the report. As written, Student B's writing style is relatively easy to read; however, I have made a number of edits and suggestions to the results section. These comments were to offer ways to more accurately describe the results and to avoid the use of jargon that would not be widely understood. The description of the test results illustrates some confusion regarding the correct interpretation of test results and their relationship to the presenting disorder. The errors that were made were more fundamental errors in test interpretation than those found in Student A's report. Student B also failed to describe results for all of the tests that are required for this case. A notable strength in Student B's report, however, is the inclusion of a recommendation regarding protection from noise exposure. This was an important recommendation and one which none of the other class members recognized as necessary.

The errors represented in Student A's and Student B's first case reports were typical of those made by other students in the class. In most cases, the students identified the most important case history information, but they exhibited confusion in the interpretation of one or more test results. All students had difficulty making correct recommendations, although Student B's report was the most accurate.

Clinical Case 2 report: Student B. Student B's second report demonstrates improvement relative to the first report. The case history section of this report is more complete than in the first report, as is the description of the test results. While Student B shows improvement relative to the first report, s/he has still omitted some details that should have been included and decided to include a test that is not necessary for the diagnosis of this disorder. Interestingly, when I re-read this report, I think that I should have taken off a point for an inaccuracy in the description of the acoustic reflex test results. The error that Student B made in the description of the acoustic reflex

results does not change the diagnosis or recommendations for this case, and Student B has clearly improved relative to the first report. A notable strength of this report is in the recommendation section. Student B has made many appropriate recommendations and is clearly demonstrating high-level thinking regarding how to counsel a client with a history of noise exposure who is showing evidence of hearing loss resulting from this exposure.

2008 Student Papers
In evaluating the performance of the class as a whole, all of the students scored well in the content of their papers and covered the audiology aspects well, even the relatively weak papers. The errors tended to be in the medical details and in the form of the papers (i.e., organization, writing style, reference style). This represents an improvement over the student presentation assignment in 2007 where many students failed to adequately describe the audiology information. In terms of the grade distributions for the two papers, students earned 1 C, 3 Bs and 2 As (average grade = 88%) on the first disorder paper, and 1 B and 5 As (average grade = 94%) on the second disorder paper.

2008 Student Paper on Bell's Palsy This paper represents the 2nd paper this student wrote for the class and is an example of relatively high-level work. In this paper, the student has described the important characteristics of the disease, the associated auditory symptoms and characteristics, the expected results for a range of audiologic tests, and the medical aspects of the disease. Notably, this student has included many of the details that were either incorrect or omitted in the Bell's Palsy presentation from 2007.

Reflections

In reflecting on the student's performance during the Spring 2008 semester as compared to the Spring 2007 semester, it seems clear that it is important to structure a class with the primary goals in mind and to continually check that the content of the lecture and the form of the assignments are consistent with these goals. My initial approach to teaching AUD 811 was based on my goals for the class; however, at the end of the first semester, it was clear that I needed to realign the emphasis of the course with these goals. While I feel that I can further improve the way I teach diagnostic audiology skills in this class, the class is now structured in a way that these skills are emphasized in lecture and in the assignments. I can work within this framework to refine my approach to teaching these skills. I was particularly encouraged to see how well the students incorporated audiology information in their papers, after feeling that audiology was almost an afterthought in the student presentations from the previous year.

While I was generally happy with the decision to use a group-discussion format for covering the clinical cases on the AAA CD, I am still working to refine the way I structure this exercise. One limitation to the group-discussion approach I used is that the discussion may be dominated by the students that are most confident in their knowledge or skills. Students who are less outspoken or less sure of what they know may be reluctant to contribute. I saw evidence of this in the group discussions over the course of the semester. In future semesters, I will need to change the structure of the group discussion so that all students can participate and so that students don't get

in the habit of having a small subset of classmates dominate the discussion and the decision making.

I was also generally happy with the use of the rubrics for grading the clinical case reports and the papers. I certainly felt there was more objectivity in the grading process and that there was a better-defined rationale for assigning points for various aspects of these assignments. However, I am certain that I will continue to refine the rubrics the next time I teach this class. For example, in the rubric for the clinical case reports, there seemed to be too much overlap between some of the categories such that a high score in one category always resulted in a high score in another category. Also, I continue to feel that it is difficult to completely express the strengths and weaknesses of student performance through the rubrics, at least as they were originally conceived. For example, I frequently made comments and suggestions for rewording different sections of a student's report or paper. I don't know that my provision of suggestions necessarily meant that the student's performance was limited; in some cases I simply wanted to add information to challenge the student to express an idea more clearly or to see links between ideas. Using the rubrics helped me, but I still found it difficult in some cases to link a grade to what the students were writing. Like designing a course, developing an effective rubric is a process that should be informed by previous experience and by continual reflection on the key aspects of the assignment