A SEAT FOR YOU!

Year 10
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Background Information/Introduction:

In Australia, 1 in 6 individuals are affected by hearing loss. Approximately 30,000 Deaf Auslan users (the sign language of the Australian Deaf community) are living with total hearing loss. This is only for Australia, but how many are there altogether in this world? Studies have shown that over 5% of the world’s population – 360 million people – have disabling hearing loss, 328 million of them are adults and 32 million are children. My school is located in North Parramatta, which is near Tara Anglican Girls School and Garfield Barwick School (a school for children who have a disability of hearing loss.) My school is a partner to the Garfield Barwick School and we always welcome their students into our school. In my school’s classrooms, we have installed ceiling speakers, which are connected to the classroom amplification systems. These systems help the students with the disability of hearing loss hear better, but I would like to help these students by figuring out which seat in the classroom is the best for them to hear much better. The ceiling speakers do help with hearing because I had found out that hearing aids are an effective hearing solution for many people, but they don’t always help everyone. I knew that having a hearing aid on and also hearing a teacher’s voice come out of a ceiling speaker would be very effective with helping students with the disability of hearing loss hear much better than what they would usually hear before. As I started talking to my Science teacher about how I wanted to do my project based on the classroom amplification systems and the ceiling speakers, he gave me an idea from a past student’s project which related to what I wanted to do as well and both my Science teacher and I thought it was a great idea to work on.

Figure 1: Classroom Amplification Systems

Figure 2: Sound sensor & Ceiling speaker
**Aim:**
To identify the best seat acoustically to sit a hearing impaired student in my two-homeroom classrooms with ceiling speakers.

**Hypothesis:**
The optimum seats acoustically should be the ones directly below the ceiling speakers as they are closer to the sound source.

**Risk Assessment:**

<table>
<thead>
<tr>
<th>Moving between tables and chairs – might trip over.</th>
<th>Medium</th>
<th>Move the chairs out of the way because the tables are needed for the experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Might have to go on a ladder</td>
<td>Medium</td>
<td>Move any object out of the way that will cause the ladder to fall over etc.</td>
</tr>
<tr>
<td>There may be cables or cords on the floor</td>
<td>Low</td>
<td>Move the cords or cables out of the way to a place where they won’t be in the way.</td>
</tr>
</tbody>
</table>

**Experimental Overview:**

I will be doing readings at every seating location in my home classroom. I will do readings with no students in the class and then with students in the class. The average reading for each seat will be on a classroom map. The last thing I want to do is create a decibel contour map for the room, with students and without students. By using a computer program called 3DField, this will help me get the results of the decibel contour map. The decibel contour map will show me which seats in the room in which the sound level are strong or weak. To do this, I will have to record the measurements onto every seat in the room on a sheet of paper that has the room plan on it then I’ll be able to process my data onto the decibel contour-mapping program.
Method:
1. Connect the sound data collecting device to a tripod
2. Set the height of the stand that is holding the sound sensor to the approximate height of a Year 10 student’s head would be.
3. Find 3 tones using a program called TrueRTA that would be close to a male/female teachers voice: For this project, I used:
   - Lowest tone: 85 Hz
   - Highest tone: 255 Hz
   - Multi-frequency tones (including the lowest and highest tone)
4. Draw a quick sketch of the room.
5. Once plan is drawn, play the TrueRTA tone – making sure that there is no other sound besides the tone.
6. Take measurements from the sound device of each seat in the room.
7. Do these readings 3 times for each room
   - Reading 1: Lowest tone frequency
   - Reading 2: Highest tone frequency
   - Reading 3: Multi-frequencies
8. After finally collecting all the data from every seat in the rooms that have ceiling speakers:
   - Paste them into Excel
   - Save it as a text file
9. Use the text saved files in a program, which turns the information into decibel contour maps, which will show the areas that are strong and weak.

Results – No Students In Classroom:

1. [Image of a chart showing measurements]
The red targets I have drawn on are representing the ceiling speakers in my home classroom and where it is exactly positioned. The two speakers at the front of the class are just in front of the first row and the speakers in the middle are positioned right between the second and third row.

2.

<table>
<thead>
<tr>
<th>Distance from left wall</th>
<th>Distance from front</th>
<th>Decibels</th>
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<tbody>
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3. Decibel contour map of classroom with no students in it.

The yellow dots on the decibel contour map indicate where the decibels are positioned.
4. After showing the original hand drawn copy of the classroom layout and the decibel contour map, I wanted to make a final copy and show where the seats and the decibels would exactly be positioned if they were combined together.

The red targets indicate where the ceiling speakers are located in the room.
Results (2) – Students In Classroom:

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ADD SUPERIMPOSED IMAGE ON ROOM LAYOUT – FINAL (ROOM LAYOUT WITH CONTOUR MAPS BEHIND IT)
4. A final copy of my classroom layout and decibel contour map combined together with the students inside the classroom.
While I was comparing the two sets of data, I had found out that the data, which had no students, was louder than the data that had students. In the aisle way between the tables, it showed that it was louder in that section that had the data of no students but for the data with students, it was not that loud. For the data with no students, the right side was louder than the left side, which I found interesting because on the left side of the room towards the back, there are two extra ceiling speakers but I did not add them in the diagrams because they weren’t near the seats a student would most likely sit in. So I had thought that the left side would’ve been louder. However, for the data with the students, it shows that between the first and second row and near the third row in the aisle it is louder than the back. Comparing these two room layouts with the decibel contour map, I had figured out that the loudest areas in the room are at the front two rows in the room but for a hearing impaired student, the best seats for them would be at the front row near the edge, next to the wall because on the room layout with the decibel contour map, on the front row to the seats near the wall, it’s the darkest colour out of the rest of the seats meaning it was also the loudest seat so the hearing impaired student would definitely hear better if they sat in those seats.
Conclusion:
When I began planning my project, I wanted to achieve in finding the best seat in a room with ceiling speakers for a hearing impaired student. I had predicted that the best seat(s) in the room would be the seats that are near the wall cause I assumed that the sound travelling from the ceiling speakers would bounce back from the walls and the beams on the ceiling. Not only did I achieve my aim and hypothesis, but I had also found out the weak spots to sit in during class and it will benefit both hearing impaired and non-hearing impaired students, they would know the best seat to sit in if they want to hear the teacher clearer and better.

Acknowledgements:
I would like to thank my science teacher for helping me come up with an idea and for also helping me expand it. He helped me till the very end of my project and without him I wouldn’t have been able to achieve my aim of this project. Thank you for staying back at school a few days to help me by setting up the tones, allowing me to use the school equipment, setting up the decibel contour maps, proofreading my work, taking photos for my project and for correcting any data that was done wrong.

I would like to thank my classmates for being involved in my project and also apologise for the times where I had to play the tones during class time, I’m sorry if the tones bothered you while you were all concentrating in Maths.

I would like to thank a past student and his project. He had done a project a bit similar to mine and looking over it as helped me with my own project.
Bibliography:

• Types of causes and treatment for hearing loss, viewed on the 8/8/16
  o [http://www.hearingloss.org/content/types-causes-and-treatment](http://www.hearingloss.org/content/types-causes-and-treatment)

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  o [www.who.int/mediacentre/factsheets/fs300/en/](http://www.who.int/mediacentre/factsheets/fs300/en/)