FM Systems and Wireless Technology

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Learning Objectives

1. Learn what an FM system is and how it works
2. Understand how FM systems help in different settings
3. Learn how wireless hearing technologies work
4. Discuss some of the most common wireless technology devices used among children with hearing loss
“Parents tend to talk more with their children when wearing an FM system, and children will imitate… sounds more often”

“Some children wearing FM systems regularly at home, showed an improvement in speech and language development”

(Benoit, 1989; Moeller et al., 1996)
What is an FM system?
Who Benefits

• Any child in ANY group situation
• Any child in ANY situation with:
  background noise
  where they are receiving new information
  where the speaker moves around the room
• Any child who has ANY distortion in their hearing
• Any child who has poorly developed language structure
How does an FM system work?

1. Speaker – microphone

2. Speaker – transmitter

3. Receiver – child with hearing aids or CIs

Source: Phonak Pediatrics
Types of FM systems

Personal FM systems

• The “FM transmitter” picks up the desired signal from the microphone (often the speaker’s voice) and sends the signal by radio waves to the “FM receiver.”

Soundfield FM systems

• The teacher wears a microphone and speakers are placed in the classroom.
• The teacher’s voice is able to be amplified louder and above the noise level of the classroom, throughout the whole room.

Personal FM systems are recommended over Soundfield FM system for children who have hearing loss or auditory processing disorder.
Personal FM Systems vs Soundfield Amplification

Speech Recognition of 28 Children with Hearing Loss

Percent correct scores for words in sentences

- Hearing Aids or Cochlear Implant Only
- Classroom Infrared
- Desktop FM
- Personal FM

Source: Australian Hearing
When to use an FM system?

- Group environment
- Therapy sessions
- Child at a further distance from the speaker
- Reverberant environment
- Classroom
- Noisy environments
Video: Hearing Loss in the Classroom

https://youtu.be/RBrnvGKLF_Q
<table>
<thead>
<tr>
<th>DM (Digital Modulation)</th>
<th>FM (Frequency Modulation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robust &amp; Steady Signal</td>
<td>Dropped signal</td>
</tr>
<tr>
<td>Wider Bandwidth (100-7000 Hz)</td>
<td>Interference with channels</td>
</tr>
<tr>
<td>Utilizes instructions/guidelines to replicate signal (recipe)</td>
<td>Less Bandwidth</td>
</tr>
<tr>
<td>All or nothing signal</td>
<td>Utilizes an image of the sound to replicate it (Photocopy)</td>
</tr>
<tr>
<td></td>
<td>Distortions &amp; replications that aren’t good copies</td>
</tr>
</tbody>
</table>

Bielski, B. (2015) What’s the difference between frequency modulation in FM systems and digital modulation?  
DM (Digital Modulation) vs. FM (Frequency Modulation)

Benefits of using an FM system

Reduces background noise

Improves communication

Source: Phonak Pediatrics
Benefits of using an FM system

- Increases sports’ participation

- Improves communication in the car

- Increases academic performance

Source: Phonak Pediatrics
Factors that affect a child’s hearing

- **Background noise**
  - FM system– reduces background noise

- **Distance from the source (speaker)**
  - FM system– decreases the distance from the speaker

- **Reverberation (echo)**
  - FM system – decreases the echo in the classroom

An FM system helps to improve speech understanding in noisy environments.
FM system

Advantages

1. Increases access to speech
2. Eliminates feedback from the hearing aids
3. Provides full access to the caregiver’s voice
4. Increases participation in school and extracurricular activities
5. Increases incidental learning
FM Systems Styles

Oticon - AMIGO

- Amigo T10 Personal Transmitter
- Amigo T20 Educational Transmitter
- Amigo T21 Team Teaching Transmitter
- Amigo R1 Universal Receiver Multi-Channel
- Amigo R2 Universal Receiver Multi-Channel w/ Channel Switch
- Amigo R7 Dedicated Receiver for Sumo models

Phonak - INSPIRO

Source: Oticon Pediatrics

Source: Phonak Pediatrics
Source: Phonak Pediatrics
Wireless Technology

OTICON: Streamer – Mini Mic – TV adapter

Phonak: ComPilot-Mini Mic – TV adapter

Source: Oticon Pediatrics

Source: Phonak Pediatrics
1. Phonak:

2. Oticon:

3. FM Solutions for Cochlear Implants

4. Hearing Loss at School: https://youtu.be/Fa6qFiQKpxU

5. Hearing Loss in the Classroom: https://youtu.be/RBrnvGKLF_Q

For questions or to request materials, please visit our website:

Hear to Learn: http://www.heartolearn.org/tutorials/index.html


Website— “Hear to Learn”

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