# Phonak Insight

April 2016

# Roger™ Touchscreen Mic Small Group mode

## Changing the dynamics of group activities in the classroom

Teaching styles and learning methods are becoming more and more interactive and students with hearing loss or other hearing difficulties need clear access to not only the teacher's voice but also their peers' voices. The new Roger Touchscreen Mic has been designed with the ever-changing, dynamic classroom in mind. The Roger Touchscreen Mic has an automatic microphone mode that allows it to be worn around the neck of the teacher or easily placed on the table amidst a group of 2-5 students. The microphone responds automatically to the voices in the group so that children using Roger receivers have full access to group discussion and can be active participants in group learning activities.

## Introduction

Introduced in 2013, Roger is the standard in adaptive digital 2.4 GHz wireless transmission, offering maximum performance for listeners in noise. Roger wireless microphones precisely and continually measure the ambient noise. These measurements in turn control the gain of Roger receivers, adaptively adjusting the gain based on the acoustical environment in which the Roger system is being used. This advanced dynamic behavior has led to significant improvements in speech recognition in noise, especially at higher noise levels, often seen in everyday life and in the classroom. Speech testing in noise revealed that listeners using Roger achieved 54% improvement in speech perception scores compared to traditional FM and an impressive 35% improvement over Dynamic FM.[1]

There is a Roger system for virtually every hearing instrument, cochlear implant and bone-anchored hearing aid. Roger also works alongside other existing classroom technologies such as interactive whiteboards and other multimedia devices.

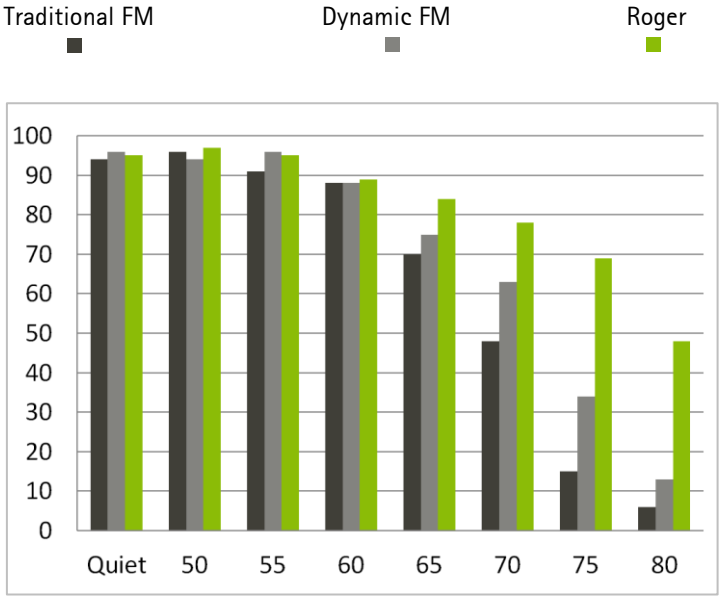


**Figure 1. HINT percent correct scores for total words correct as a function of noise level for traditional FM, Dynamic FM and Roger. Distance between loudspeaker generating speech and listener was 5.5 m. N=11.[1]**

PHONAK
life is on

## The modern classroom

Roger microphones are successfully used in many classrooms around the world by teachers and students to ensure students with hearing loss or other hearing difficulties have clear access to the teacher's voice throughout the school day. However teaching styles are becoming increasingly more dynamic and interactive with estimates of up to 34% of the day involved in peer or group discussion activities.[2, 3] Figure 2 shows the breakdown of teaching style and classroom activities from an internal Phonak study in multiple schools and multiple countries.[3] Although dynamic and participatory styles of learning are becoming standard, the ability of hearing impaired children to effectively hear in these situations has been limited. Funding is routinely limited to one microphone that is usually only worn by the teacher.

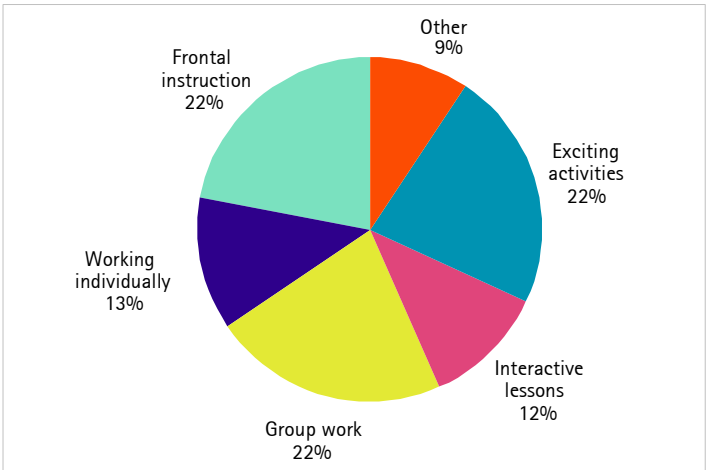


**Figure 2. Occurrence distribution of different classroom activities across several schools.**

## Roger Touchscreen Mic

Phonak introduces the next generation of Roger for Education microphones designed for the fast paced modern classroom with a variety of teaching styles and learning activities, including the new Roger Touchscreen Mic, Roger Pass-around and Roger Multimedia Hub. The Roger Touchscreen Mic can be clipped to a lanyard worn by the teacher for standard 'frontal' lectures but is also versatile enough to be placed on a table or desk to provide students with hearing loss access to the peers' voices during small group activities. With an automatic microphone mode, Roger Touchscreen Mic responds to the changing environment in the classroom without requiring any action by the teacher.

## Automatic behavior

The Roger Touchscreen Mic features an accelerometer, which informs the device of its orientation and motion. An accelerometer is a miniature mechanical and electronic component that measures accelerations in three dimensions at high speed and with high precision.

The Roger Touchscreen Mic can detect several situations for which it automatically adapts and optimizes the settings. When the device is hanging around the neck of the talker the **Lanyard mode** is activated, featuring an adaptive beamformer focusing in the direction of the talker. If the device is lying horizontally (e.g. on a table during group activities) the **Small Group mode** is enabled, which automatically adapts the beamformer to target the active talker at 360 degrees around the Roger Touchscreen Mic. Additionally, a special beamforming zoom mode – **Pointing mode** – allows the user to hold the device in the hand and capture the sound from a specific source or talker based on the direction he or she are pointing it.

## Small Group mode

The Roger Touchscreen Mic Small Group mode is activated automatically by a standalone or primary Roger Touchscreen Mic when it is placed flat on a table or the floor. When used with a Roger Dynamic SoundField and a MultiTalker Network, the SoundField and all secondary microphones are temporarily disabled when the primary microphone is in Small Group mode. Small group discussions are not meant to be broadcast, but should stay in the small group until shared with the class as a whole. This mode uses an array of three omnidirectional microphones, shown in Figure 3, to create a beam targeting the talker and suppressing noise coming from other directions. Once the small group activity is complete and the teacher clips the Roger Touchscreen Mic to the lanyard mode, the network is automatically re-established with zero hassle for the teacher.

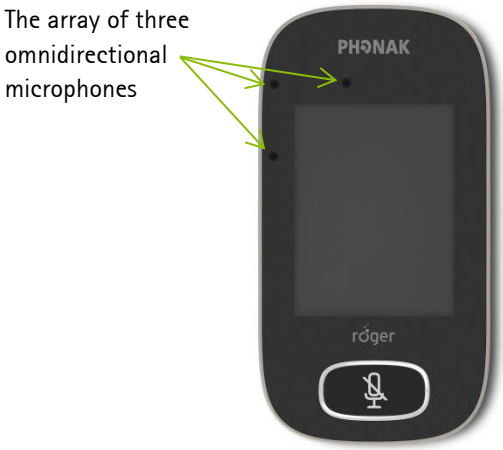


**Figure 3. Array of three omnidirectional microphones on the front of the Roger Touchscreen Mic.**

Small Group mode is designed so that the Roger Touchscreen Mic can be placed in the center of 2 to 5 group members during group learning or listening activities. Specific signal characteristics, such as signal-to-noise ratio and energy level, are analyzed and used to localize speech information and to identify the talker's direction. This allows the device to automatically follow the conversation by always focusing towards the active talker.

Often in group discussions, conversation can move quickly from one talker to the next. It is not rare to observe people interrupting each other. It is highly important for a child with hearing loss that no information is lost during such challenging situations. The Small Group mode adapts smoothly during transitions between talkers and ensures a pleasant sound quality without interruptions, even in the most challenging situations where people are talking at the same time and interrupting each other.

Additionally, in Small Group mode, the dynamic range is widened by shifting the compression knee-point to higher sound pressure levels. This results in an improved signal-to-noise ratio in situations with low to moderate ambient noise (less than 80 dB). The larger dynamic range also provides a more natural sound, improving the overall sound quality.

The Small Group mode is activated by placing the microphone on a flat surface such as a table – beam configuration, noise cancellation and gain are then controlled automatically. Placing a Roger Touchscreen Mic on the table in the middle of the group is all that is required to give students access to the full conversation and allow them to fully participate in the group discussion.

## Students prefer Small Group mode

Bench testing at the Phonak Audiology Research Center (PARC) in Warrenville, IL used simulated small group conditions with recorded voices (4 group members talking in a room with 70 dB noise level) to evaluate the Roger Touchscreen Mic Small Group mode and the Roger Pen Conference mode. Conference mode in the Roger Pen functions similarly to Small Group mode, in that the Roger Pen also has an accelerometer which notices the position and movement of the microphone and automatically activates an omnidirectional microphone when placed on a flat surface like a table. Testing revealed a 2 dB average improvement in signal-to-noise ratio with the Roger Touchscreen Mic Small Group mode compared to the Roger Pen Conference mode.

In a further internal validation study conducted at PARC, students were asked to evaluate the performance of multiple microphone options for small group activities in the classroom. A Roger Touchscreen Mic prototype was used with two different implementations for use with small groups: the Small Group mode and the Conference mode as is currently implemented in the Roger Pen.

10 children between the ages of 10-18 were involved in this study. All students wore bilateral hearing solutions, either hearing aid or cochlear implant and consistently used Roger in their mainstream classroom settings. Students were asked to participate in small group activities using the Roger Touchscreen Mic and compare three different settings: Roger Touchscreen Mic turned off (to represent the current solution for this listening activity - no microphone), Roger Touchscreen Mic Small Group mode and Roger Touchscreen Mic with the Roger Pen Conference mode implemented.

The overall noise level in the children's classrooms was measured when possible and the long term average noise level across 9/10 classes was 68 dBA during group work activities.

Students rated each microphone mode (including microphone turned off) based on sound quality, comfort, speech understanding, noise and overall preference. All 10 students preferred listening in Small Group mode over the no-microphone mode and 7 of 10 students preferred listening with Roger Touchscreen Mic Small Group mode compared to the Roger Pen Conference mode.

## Summary

Roger is the digital standard for remote microphone technology used in the classroom for children who have hearing loss or other hearing difficulties. The Roger Touchscreen Mic has been designed for use in the modern dynamic classroom where teaching styles and learning activities can involve peer and small group discussions as much as 34% of the time. The Roger Touchscreen Mic is versatile and can easily be unclipped from the teacher's lanyard and placed on the table, desk or floor in the middle of a group of 2-5 students to bring students with hearing loss into the discussion. Students prefer not only using the Roger Touchscreen Mic Small Group mode over no microphone but 70% also prefer Small Group mode over the Roger Pen Conference mode. The new Roger for Education portfolio from Phonak offers simplicity for the modern classroom and truly allow students to be full participants in the conversation.

## References

1. Thibodeau, Linda, PhD (2013), Comparison of speech recognition with adaptive digital and FM wireless technology by listeners who use hearing aids, University of Texas, Dallas, USA, International Journal of Audiology.

2. Lejon, Anna K., (2013) Inclusion or Exclusion. Children with hearing loss, are they really integrated into the classroom?

3. Feilner, Manuela; Rich, Stacey; Jones, Christine (2016). Automatic and directional for kids. Phonak Insight.

## Authors

Stacey Rich studied Deaf Education at the University of North Carolina and completed her Master of Clinical Audiology at the University of Melbourne in Australia in 2003. She worked as a pediatric audiologist before joining the Phonak US Pediatric and Schools team in 2008. Since 2014 she has been the Global Pediatric Audiology Manager at Phonak headquarters in Switzerland.

Xavier Gigandet obtained a Master in Electrical and Electronical Engineering from the Swiss Federal Institute of Technology (EPFL, Lausanne) in 2005 and completed a PhD in Signal Processing at the Center for Biomedical Imaging (CIBM) in Switzerland in 2009. In 2010 he joined the Digital Signal Processing team at Phonak Headquarters and has been working since 2014 as a Digital Signal Processing Engineer at Phonak Communications.