

# METHODOLOGY STATEMENT

Project name    Rockfon Educational Impact: Improved acoustics for students

Client          Rockfon/ROCKWOOL

## 1. Introduction

Date 04/02/2025

As an independent consultant, Ramboll Management Consulting has conducted an analysis to assess the impact of Rockfon acoustic solutions on learning conditions in educational buildings. The objective is to analyze the relationship between acoustical parameters, room design, and the use of Rockfon acoustic solutions in educational buildings. The analysis involved a review of international scientific literature to identify evidence supporting acoustical parameters relevant to educational buildings. Additionally, a calculation tool has been developed to estimate the impact of product sales on the overall learning environment, considering the number of students affected.

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This document provides a transparent description of Ramboll's methodology for calculating and assessing the impact of Rockfon's acoustic products on the overall learning environment in educational buildings. It aims to both describe and summarize the inputs and assumptions utilized in the process.

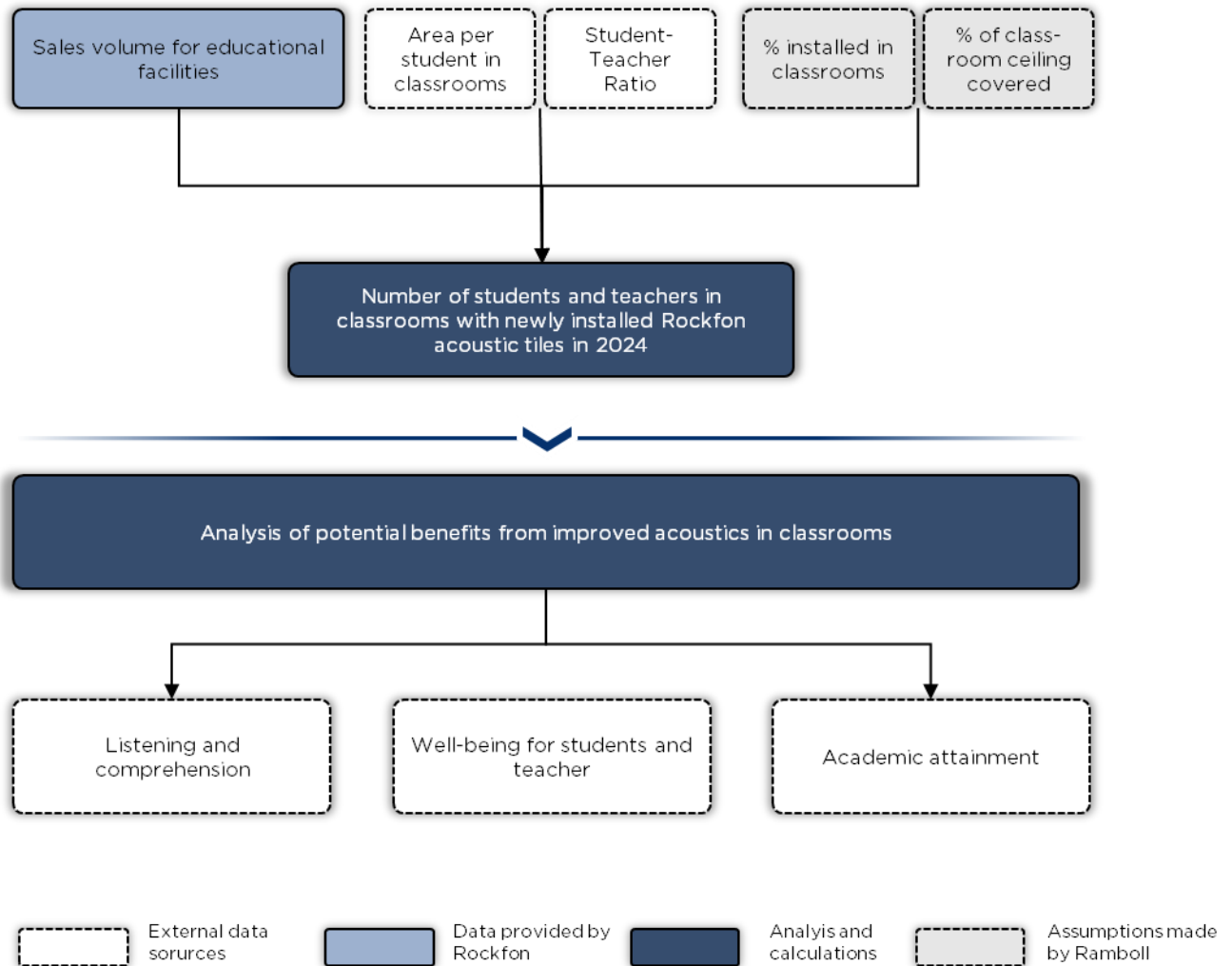
## 2. Methodology

The calculation of the impact from installed Rockfon acoustical ceilings on students' learning and performance and teachers' effectiveness, involves a three-step process:

- i. Identifying likely impacts on educational environments from improved acoustic conditions on teachers and students
- ii. Quantifying the number of students and teachers affected by Rockfon acoustic solutions worldwide.
- iii. Reviewing the effect on students and teachers resulting from improved acoustics

The **chain of impacts** illustrates the underlying factors linking sold products to their effect on students' learning and performance, as well as teachers' instructional frameworks and working conditions. The chain of impacts is illustrated below in [Figure 1](#).

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**Figure 1: Chain of impact from sales volumes to effect on learning and performance**

As shown in Figure 1, several factors influence the chain of impact from Rockfon ceiling sales to students’ learning conditions. The key intermediate element in this process is the number of students affected by the product, which must be quantified to assess its impact on learning and performance. This impact results from improved acoustics in the learning environment following the installation of Rockfon ceiling elements. Alternatively, this measure could also be expressed in terms of the number of teachers affected.

The methodology for this quantification is detailed in subsections 2.1 and 2.2.

**2.1 Quantifying the number of affected students and teachers**

To evaluate the impact of acoustical ceilings on students' learning and performance, as well as on teachers' effectiveness, the initial step involves quantifying the number of students who will benefit from an improved acoustic learning environment.

To determine the number of students and teachers affected by a year's sales of Rockfon ceilings, various intermediate calculations and inputs are required:

- a) Sales volumes (m<sup>2</sup>) to educational buildings, per region
- b) The share installed in classrooms
- c) The share of a classroom ceiling that is covered
- d) The average area (m<sup>2</sup>) for a student in a classroom
- e) The student to teacher ratio

The calculations for steps b) to d) are subject to a high degree of uncertainty, primarily due to limited data sources and variability among estimates. Whenever possible, Ramboll experts have verified these calculations based on prior projects and their expertise. It must be noted, that it has not been possible to distinguish between sales volumes for new buildings and building refurbishment since data detailing this has not been available.

The methodology employed for each of the estimates (a to d) and the quantification method for each region are detailed below:

- a) **The regional sales volumes** for the years 2016-2024, which have been sold to educational buildings, are provided by Rockfon for each region (Asia-Pacific, Europe and North America).
- b) **The Rockfon ceiling installation share in a classroom** is found by assuming a priority for installation in classrooms compared to the rest of the school area. To ensure data consistency, we presume that the percentage of installations allocated to classrooms is uniform across regions, with 60% of ceilings installed in classrooms. The estimate is based on research but is subject to much uncertainty.
- c) **The share of a classroom's ceiling which is covered** by Rockfon acoustic ceiling assumed to be 90 % based on Ramboll's experience and knowledge from educational projects. Within acoustic engineering. This means that 10 % of the ceiling area is allocated to lighting, air devices and other elements.
- d) **The average classroom area per student** (in square meters) is calculated based on data from countries that provide student spacing information. First, a country-specific average is determined, which is then used to compute a region-specific average. Due to data limitations, different approaches are applied across regions. The results are presented in the table below.

**Table 1: Estimates of the average area (m<sup>2</sup>) per student in classrooms**

Country region	Average area per student (m <sup>2</sup> )
FEA	1,92
Europe	2,23
North America	3,38

For the Far East Asia region (FEA), the estimate is based on data from Japan, Korea, and China. For Europe, data from Denmark, the United Kingdom, Belgium, and Spain are used, while for North America, data from the United States and Canada are included. For the latter, the average classroom size is determined using data from several U.S. states (California, New York, Texas, Pennsylvania, Illinois, and Georgia). The U.S. average is calculated as an equally weighted estimate based on these six states. Additionally, the overall North America estimate includes official data from Canada (Government of Canada, 2024).

In cases where only classroom area data was available, the average space per student is calculated using the average number of students per classroom. This figure is primarily derived from OECD estimates (OECD, 2021), which provide the average number of students in primary and lower secondary education for each country in 2021.

A key limitation of this approach is that the region-specific calculations are based on equally weighted averages within each region, without accounting for the distribution of Rockfon sales across these countries. This means the analysis assumes that sales volume is evenly distributed within the region and that the countries included are fully representative of the entire region.

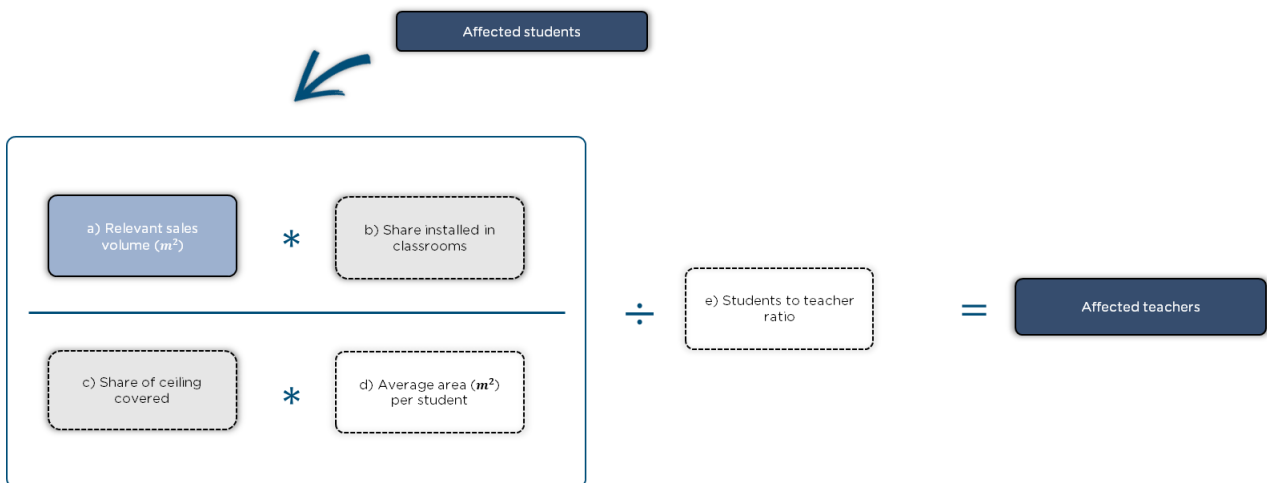
- e) The **student to teacher ratio** is determined by determining a region-specific average, using data from the OECD on primary and secondary education levels. For China, where data was unavailable in the OECD database, information was sourced separately from The Global Economy.<sup>1</sup>

**Table 3: Estimates of the average number of students per teacher**

Country region	Students to teacher ratio
<b>FEA</b>	<b>14,12</b>
<b>Europe</b>	<b>12,00</b>
<b>North America</b>	<b>14,36</b>

By combining the estimates from (a) to (e), we determine the number of students and teachers affected by the sold Rockfon ceilings in each region. The methodology for calculating the final number of students is illustrated in Figure 2 below.

<sup>1</sup> See References



**Figure 2: Calculating the number of students affected.**

In words, the calculation process is as follows:

1. The volume of ceiling tiles sold in square meters each year to a specific region is separated into volumes sold exclusively to education (step a).
2. The sales volume to educational facilities is then multiplied by the share of tiles installed specifically in classrooms.
3. The sales volume to classrooms is divided by the average area (m<sup>2</sup>) per student (assuming floor area equals ceiling area), subtracting the share that does not consist of ceiling tiles. This calculation estimates the **total number of students** benefiting from improved acoustics due to the installation of Rockfon acoustic solutions worldwide.
4. To assess **the number of teachers affected**, the number of students affected is divided by the average number of students per teacher in the specific region.

## 2.2 Assessing types of effect on students from improved acoustics

To evaluate the potential effects of improved acoustics in educational environments, we consulted a Ramboll Acoustic Engineer who assessed three key studies on the subject. These studies explore different aspects of acoustic improvements: **enhanced comprehension** (Wang, 2014), **improved well-being** (Klatte, Seidel, & Leistner, 2017), and **increased academic attainment** (Shield & Dockrell, 2008).

While we do not directly quantify the impact of Rockfon acoustic solutions—since existing classroom conditions are unknown and the extent of improvement varies across locations and even between individual educational institutions—this assessment outlines the potential benefits that could be achieved through improved acoustic environments in schools.

### 3. About Ramboll

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. The company employs 17,500 globally and has especially strong representation in the Nordics, UK, North America, Continental Europe, Middle East and Asia Pacific.

With more than 300 offices in 35 countries, Ramboll combines local experience with a global knowledgebase constantly striving to achieve inspiring and exacting solutions that make a genuine difference to our clients, the end-users, and society at large. Ramboll works across the markets: Buildings, Transport, Planning & Urban Design, Water, Environment & Health, Energy and Management Consulting. [www.ramboll.com](http://www.ramboll.com)

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## 4 References

### i. Average m2 per student

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### ii. Average students to teacher ratio

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