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Autism and Occupational Noise

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Abstract
perhaps one of the most frequent and least understood symptoms in people with autism spectrum disorders (ASD) is auditory hypersensitivity. Therefore, the aim of this study is to analyze the impact of excessive noise at school and the autistic community. The ethnographic research was applied, given that it best describes the community and its way of life. According to the Brazilian Association of Technical Standards (ABNT) the noise limit inside the classroom is 40 to 50 decibels. However, in this study, the noise reached an average of 80 decibels, mainly in rooms with more than 25 students. In addition, the noise in the courtyard, at recess, reached more than 100 decibels. The bearable limit for the human ear is 65 decibels, according to the World Health Organization.

Keywords: ASD; Autism; Ethnography; decibels.

1. Introduction

People are exposed to different sound sources on a daily basis, which can affect them positively or negatively. Sounds of rain or calm music bring relief and a sense of rest.

Already the sound of environments with a lot of conversation, generates discomfort and stress. Sound waves play a very important role in people's daily lives and have characteristics that can help them constantly.

It is common to find people with ASD (Autistic Spectrum Disorders) who suffer crises due to excessive noise in schools. Many individuals with ASD have sensory hypersensitivity to environmental stimuli. The factor is even one of the criteria taken into account when closing the diagnosis.

The student noise has a ripple effect. Some shout to make their voices heard over the noise of other students. And the teacher, in turn, is forced to speak even louder in an attempt to make himself understood; not to mention the dragging of chairs and external noise, such as traffic, for example.

All of this takes away students' concentration, hinders their reasoning and even poses a risk to their hearing. In the research, it was noticeable that students and teachers with ASD were impacted. It's as if they listen to all the sounds in the environment at once without focusing attention on any of them, causing an overload in that sense. It is something that is out of their control.

In order to understand this issue, an attempt was made to present a bibliographical review on autism, occupational noise and school management. The result is presented in an ethnographic way, where noise is one of the many risks that can affect the autistic community.

2. Autism

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by atypical development, behavioral manifestations, deficits in communication and social interaction, repetitive and stereotyped behavior patterns, and may present a restricted repertoire of interests and activities (ALONSO, 2023).

Warning signs in the child's neurodevelopment can be perceived in the first months of life, with the diagnosis established around 2 to 3 years of age. Prevalence is higher in males (HADJIPANAYI and GRIGORIOU, 2020).

Identifying developmental delays, timely diagnosis of ASD, and referral for behavioral

interventions and educational support at the earliest possible age can lead to better long-term outcomes considering brain neuroplasticity (LOTTU, 2022).

It is noteworthy that timely treatment with early stimulation should be recommended in any case of suspected ASD or atypical development of the child, regardless of diagnostic confirmation (MILLER, 2022).

The etiology of autism spectrum disorder remains unknown. Scientific evidence points out that there is not a single cause, but the interaction of genetic and environmental factors. The interaction between these factors seems to be related to ASD, but it is important to emphasize that "increased risk" is not the same as what causes environmental risk factors (WALKOWIAK, 2021).

Environmental factors can increase or decrease the risk of ASD in genetically predisposed people. Although none of these factors appear to have a strong correlation with increased and/or decreased risk, exposure to chemical agents, vitamin D and folic acid deficiency, substance use (such as valproic acid) during pregnancy, prematurity (with gestational age below 35 weeks), low birth weight (< 2,500 g), multiple pregnancies, maternal infection during pregnancy, and advanced parental age are considered contributing factors to the development of ASD (WILSON, 2023).

Autistic Spectrum Disorder (ASD) is the result of physical and functional changes in the brain and is related to motor, language and behavioral development. TEA affects the child's behavior. The first signs can be noticed in babies in the first months of life (RUDOLPH, and TULLY, 2019). In general, people with autism spectrum disorder may experience the following signs:

- Difficulty interacting socially, such as maintaining eye contact, identifying facial expressions and understanding communicative gestures, expressing emotions and making friends;
- Difficulty in communication, characterized by repetitive use of language and difficulty initiating and maintaining a dialogue; It is
- Behavioral changes, such as quirks, excessive attachment to routines, repetitive actions, intense interest in specific things and imagination difficulties

Although it still has no cure, TEA can be treated in numerous ways. With the support of a multidisciplinary team (different professionals), the child can develop ways to communicate socially and have greater emotional stability. No child with ASD can be discriminated against due to their difficulties or prevented from attending any public place (SHARKEY and JOCKSCHAT, 2023).

2.1. hypersensitivity

Hyperacusis: the child who has hypersensitivity classified as hyperacusis presents an alteration in the perception of sound pressure, that is, in the "volume" of the ambient sound. Thus, sounds with sound pressure below 120 dB can cause discomfort and pain, triggering behavioral changes. It is that child who, when he suddenly hears a very intense sound, immediately takes his hands to his ears and may present a behavioral change in the sequence (SELVAPANDIYAN, 2023).

Phonophobia: in this case, the child does not present alteration in the perception of sound intensity, but certain sound frequencies (contained between 20 and 20,000 Hz), instead of being transferred and interpreted by the auditory cerebral cortex, are transferred to brain areas that manage the behavior, especially the limbic system (which makes up the system of emotions). The behavior system in the human brain should not receive electrical stimuli from the auditory system, and when this happens, disruptive behaviors such as aggression and self-harm may arise. In fact, data indicate that 85% of Brazilian autistic people are out of the job market. (REIS; ANDRADE, 2023).

The correct identification and classification of hyperacusis is essential for the team to devise strategies to minimize the problem. Many individuals with ASD have sensory hypersensitivity to environmental stimuli. The factor is even one of the criteria taken into account when closing the diagnosis. A dog bark or a truck horn, for example, may be enough to cause panic in children within this spectrum (TALUKDAR, 2023).

3. Occupational Noise

It cannot be assumed that occupational exposure to noise is stable over time, nor that this exposure is not influenced by the experience of cardiovascular disease (Human beings are able to hear sounds with frequencies between 20 Hz and 20,000 Hz. Sounds with lower frequencies that 20 Hz are called infrasound (extremely low sound waves) and sounds with a frequency above 20,000 Hz are called ultrasound (very high sound waves). Realize that different animals have different sound perceptions. Elephants, for example, can hear sounds below 20 Hz, while dogs and cats can hear ultrasound around 40,000 Hz. Dolphins and bats, up to 160,000 Hz. As you have already noticed, frequency is measured in a unit called Hertz, abbreviated to Hz. assume that occupational exposure to noise is stable over time, nor that this exposure is not influenced by the experience of cardiovascular disease (TEIXEIRA; DZHAMBOV; GAGLIARDI, 2022)

The second property is sound pressure – the level of sound perception indicates the pressure with which the sound wave hits the tympanic membrane. The greater the sound pressure, the greater the sound. We could understand this sound pressure as the intensity, the volume of the sound. Sound pressure is measured in a unit called a decibel, abbreviated dB. To give you an idea, two people talking normally would be talking at approximately 50 decibels. Intensities above 120 dB can cause discomfort and pain. Occupational noise is one of the many risks that can affect workers in a work environment. If not eliminated or mitigated through risk control measures, it could harm the health and physical safety of professionals.

These measures are carried out to reach different stages of the risk reach and must be determined through specific programs that carry out an analysis of the environment. Among these measures are the PPE, for example, which you should already be familiar with. To attenuate occupational noise, there are also indispensable PPE which, together with other preventive measures, aim to promote Occupational Safety. It is interesting to point out that practically there will never be only one risk in the environment, but several factors. On the other hand, the time of exposure to occupational noise is associated with lower expression of miRNAs (LI; et al, 2023).

For each of them, it will be necessary to apply specific measures, causing the professional to end up having to use more than one protective equipment, for example. The use

of one PPE does not eliminate the need for the other, as there are cases in which all together will provide adequate protection. Occupational noise is all that noise, sound or noise pollution that is unwanted and ends up interfering with worker productivity. As this sound often cannot be avoided – such as the noise of a jackhammer for example – measures must be taken to attenuate it.

The problem with this agent is not just discomfort, it can lead to health problems and long-term occupational diseases. For this reason, there is a Tolerance Limit, determined by NR 15, which aims to avoid this type of situation. Among the misfortunes that can occur if proper care is not taken, there is the loss of hearing capacity; insomnia; headaches; dizziness; digestive problems; loss of appetite; emotional stress; and even loss of libido (among others). Noise emissions from the construction industry, whose damage and dangers take time to appear, are random and irregular (CHONG; et al, 2022).

Each of these problems may seem minor at first, but the truth is that they can trigger bigger and more serious health problems. Complete hearing loss is an example of this, not to mention depression, stress and lack of productivity. For this reason, the first step to attenuate occupational noise is to observe what NR 15 says and its tolerance limit. The noise tolerance limit is determined by NR 15. This NR is responsible for determining everything related to work safety in unhealthy activities (yes, occupational noise can be unhealthy!).

According to the standard itself, “Tolerance Limit”, for the purposes of this Standard, means the maximum or minimum concentration or intensity, related to the nature and time of exposure to the agent, which will not cause damage to the health of the worker, during your working life. Noise is a common occupational and environmental hazard; however, little is known about the use of computational tools to quantitatively analyze data on basilar membrane (MB) damage in noise-induced hearing loss (YU; WANG; SHIH, 2022). In this way, when there is noise at work that exceeds this limit, it immediately becomes unhealthy. Thus, giving the worker the right to receive the additional, which must be levied on the minimum wage in his region, equivalent to:

- 40% (forty percent), for maximum degree of unhealthy conditions;
- 20% (twenty percent), for medium-grade unhealthy conditions;
- 10% (ten percent), for minimal degree of unhealthy.

In this sense, it is worth noting that, on occasions where there is an incidence of more than one unhealthy factor, only the highest degree will be considered for the purpose of salary increase, with cumulative perception being prohibited. Continuous or Intermittent Noise is the most common classification of noise to be found in the work environment. For this, we see a table where we have the noise level in decibels, next to the maximum permissible exposure time of the worker.

Table 1: NR-15 - noise tolerance limits.

Noise level	Maximum daily exposure allowed
dB	hours
85	8
90	4
100	1
110	15

This framework must be followed strictly, and risk control measures must be taken according to the noise level. Occupational Impact Noise is recognized for presenting peaks of acoustic energy lasting less than 1 (one) second to intervals greater than 1 (one) second. To attenuate this type of noise, it must also be evaluated in decibels (dB), through a sound pressure level meter operating in the linear circuit and impact response circuit. This reading should be done very close to the worker's ear, so that it is actually efficient.

In this case, the impact noise tolerance limit will be 130 dB (linear). Also, during intervals between peaks, the noise should be evaluated as continuous noise. If there is no sound pressure level meter with impact response circuitry in place, it should be necessary to take the reading through the fast response circuit (FAST) and the “C” compensation circuit. In these cases, the tolerance limit will be 120 dB(C). Now, activities that cause impact noise greater than 140 dB (LINEAR), measured in the impact response circuit, or greater than 130 dB(C), measured in the fast response circuit (FAST), will be those that pose the greatest risk to the worker. Current literature on occupational health and safety has focused on physical hazards such as slips, trips and falls, but has ignored the risk of excessive exposure to noise (STONE; MORO, 2022).

3.1. Sound Waves

Every day we are exposed to different sound sources, which can affect us positively or negatively. Sounds of rain or calm music bring us relief and a feeling of rest. The sound of environments with a lot of conversation or intense vehicle traffic generates discomfort and stress in us. Sound waves play a very important role in our daily lives and have characteristics that can help us constantly. Audible sound waves can induce oscillating flow, which strengthens the heat transport capacity and increases heat transfer (GUO; et al, 2023).

Sound is a mechanical wave (the type of wave that needs a propagation medium), three-dimensional (it propagates in all directions) and longitudinal (the type of vibration it generates is parallel to its propagation). Sound waves can suffer the wave phenomena of reflection, refraction, diffraction and interference. However, whether these sound waves similarly affect the ripening of fruits and crops therefore requires further investigation (KIM; LEE; JEONG, 2023).

An example of reflection is the echo, which is characterized by the distinction between the sound produced by a source and the sound reflected by an obstacle. As an example of the refraction of these waves, we can cite the occurrence of

something similar to mirages. On hot days, due to the change in the refractive index of the air close to very hot surfaces, the sound undergoes deviations – this phenomenon is hardly noticed. Diffraction, in turn, occurs when sound waves go around obstacles. When the door of an environment is ajar, for example, we can hear the sound produced inside. Sound absorption results of 99% under normal incidence are obtained experimentally (ALMEIDA; et al, 2022).

Finally, interference is a phenomenon resulting from the encounter of sound waves produced by more than one source. In this contact, one wave can destroy the other, the so-called destructive interference, and generate, even in a noisy environment, regions of silence. There are properties related to our ability to perceive sound that are called physiological properties of sound. Defects with different types are defined on the surface of the material, including crack-type defects and circular defects to analyze the interaction between defects and sound waves (OIN; et al, 2023).

The human ear cannot capture all frequencies to which it is exposed, but there is a range of frequencies audible to humans, which varies approximately from a minimum of 20 Hz to a maximum of 20,000 Hz. Sounds below the minimum perceived by the human hearing system are called infrasound. Already the sounds above the maximum capture are called ultrasound. Sound waves are used for more uniform horizontal locations than the traditional method (LI; ZHAO; MA, 2022).

There are technological applications for the sounds we cannot hear. One of them is the imaging diagnosis made from ultrasound, the so-called ultrasound exams. In this type of examination, high frequency waves are directed towards organs or fetuses to be analyzed and, from the reflection of these waves, a computer generates images. Sonar, used by submarines, works similarly to an ultrasound device and shows the distance and dimensions of obstacles in front of the submarine (LI; ZHAO; MA, 2022).

4. SCHOOL MANAGEMENT

School Management comprises the organization of the school promoting effective conditions to ensure the advancement of the teaching-learning process. Thus, the school's actions must be guided and articulated in four fundamental areas: pedagogical, administrative, financial and human resources. Although, it is not known how often students receive counseling experiences (ASHE; et al, 2021).

4.1. Institutional Development Plan – IDP

The Institutional Development Plan (IDP), prepared for a period of five years, is a strategic planning and management instrument that contains the mission, vision, values, strategies and actions to achieve goals and objectives planned by educational institutions. In fact, an applied survey was carried out on 548 directors of public and private schools in Catalonia (Spain) in 2018 on sustainability practices and the results were poor (DERQUI; GRIMALDI, 2020).

4.2. Institutional Pedagogical Project – IPP

Important theoretical-methodological instrument that defines the policies for the administrative and pedagogical organization of educational institutions, guiding actions aimed at achieving its mission and objectives. More than a bureaucratic document that meets legal requirements. Own organization of academic-administrative work. Principles, purposes, guiding axes constitute elements of a political and philosophical nature that define the desired conditions of man and society and establish the set of values that the institution assumes. (LANDE; et al, 2023) have even carried out successful experiences with IPP in school telemedicine.

The IPP defines what is intended to be achieved in the future, has a utopian dimension, and must transform the principles and practices underlying an institution into reality. The process of its construction requires reflection and debates between segments of the university community on: The contemporary world view and the role of higher education in the face of the new globalized and technological conjuncture; teaching, research and extension as components for critical education of the professional and citizen future; the production and socialization of knowledge in the search for articulation between the real situation and the desired one of the different operational and administrative, conceptual and pedagogical acts. Literacy has become one of the needs of education in the 21st century. The implementation of literacy can be carried out through the management of literate culture in schools. This step is taken as an effort to optimize the quality of education and match student performance internationally (MARMOAH; SUHARNO, 2022).

4.3. Course Pedagogical Project – CPP

Its preparation by those involved in each course must dialogue with the IPP, incorporating its values. It is a document of the same size as the IPP and is based on it, even if it is restricted to a certain course. It is the reference for all course actions and decisions. Each course project will articulate the specificity of the area(s) of knowledge(s) in the context of the respective historical evolution of the field of knowledge, establishing, at the same time, the particular space related to its history. The curricular organization, which foresees the regular pedagogical actions of the course, a fundamental element of a Pedagogical Project, is today guided by National Curriculum Guidelines. In this way, it defines the formative identity in the human and professional spheres, conceptions and pedagogical orientations, curricular matrix and academic structure of its functioning. Several new aspects of the social experiment, field laboratory experiments, and data collection provide insight into the mechanisms behind the impact of CPP (SAWADA; et al, 2022).

4.4. Curriculum

Plural, dynamic and multicultural training space, based on socio-anthropological, psychological, epistemological and pedagogical references in line with the graduate's profile. Set of elements that integrate the processes of teaching and learning in a given time and context, guaranteeing the identity of the course and respect for regional diversity. curricular structure; summary; basic and complementary bibliographies; teaching strategies; teachers; material resources; administrative services, laboratories and support infrastructure. There is a vast literature that relates school spending to curriculum outcomes (COOK, 2021). There are still gaps in curricula about how community participation in

school management leads to educational outcomes (SHIBUYA, 2020).

5. Methodology

In general, this study sought a bibliographical survey on the subject, method for data collection and adopted ethnography as a methodology or research practice of this work that studied the community of people with ASD in a school environment in the interior of São Paulo.

Therefore, from the ethnographic research, people with ASD began to be studied based on a deep analysis of the behaviors, beliefs, customs and other characteristics of the community in relation to noise.

Ethnographic research has studied the more predictable patterns of perceptions and behavior in people's daily routines. It is through data collection and observations throughout the research period that the ethnographic characteristics of the population are defined. Among other techniques, focus groups were used. Ethnographic research is holistic research. In other words, it analyzes several factors of the same phenomenon.

Statistical data were obtained through a process that involved observation or other measurement. Continuous variables were used: they assumed any value in a continuous interval, example of continuous data: sound waves in Decibels (dB); discrete variables: assumed integer values, example of discrete data: people. Measures of central tendency were used to indicate a value that tends to typify, or better represent, a set of numbers. The dispersion indicated whether the values are relatively close to each other, or separated.

Photo 1: cell phone to measure dB.

To measure sound levels manually, mobile apps were extremely convenient. Although the cell phone's microphone is not as high-quality as a computer's, it was very accurate. It is not uncommon for cell phone readings to result in a difference of only 5 decibels from readings taken with professional equipment.

6. Results

IMPACT NOISE observations were made over five days in different environments and the average results were rounded. On each day of measurement there was a series of episodes that we seek to narrate in this study, according to each day:

Day 1 – Noise with loud conversation;

Day 2 - TV volume in the living room, movement also from a road at 15 m;

Day 3 - Factory sound, food processor, fast wash at 6 m;

Day 4 - Lawnmower, motorcycle at 7 m; It is

Day 5 – Rainy day with a lot of thunder.

Table 1: rounded average of Noise in Decibels (dB).

$$\bar{x} = \frac{\sum_{i=1}^{n} x_1}{n}$$

$$\bar{x} = \frac{60+70+80+90+100}{5}$$

$$\bar{x} = \frac{400}{5} = 80$$

i	x
1	60
2	70
3	80
4	90
5	100
$\bar{x}$	80

In table 1 it is possible to observe that the average of the IMPACT NOISE of the observations in the schools was of 80 Decibels (dB), being above that recommended by the Associação Brasileira de Normas Técnicas (ABNT), whose noise limit inside the classroom is from 40 to 50 dB.

Table 2: Noise variance in Decibels (dB).

$$\sigma_x^2 = \frac{\sum(x_i - \bar{x})^2}{n-1}$$

$$\sigma_x^2 = \frac{1000}{4} = 250$$

i	x	$(x_i - \bar{x})^2$
1	60	$(60-80)^2$=**400**
2	70	$(70-80)^2$=**100**
3	80	$(80-80)^2$=**0**
4	90	$(90-80)^2$=**100**
5	100	$(100-80)^2$=**400**
$\bar{x}$	80	$\sum(x_i - x)^2$=**1000**

Given the dataset in Table 2, the variance of 250 is a measure of dispersion that shows how far each value in that set is from the central (mean) value. The smaller the variance, the closer the values are to the mean; but the larger it is, the more the values are far from the mean.

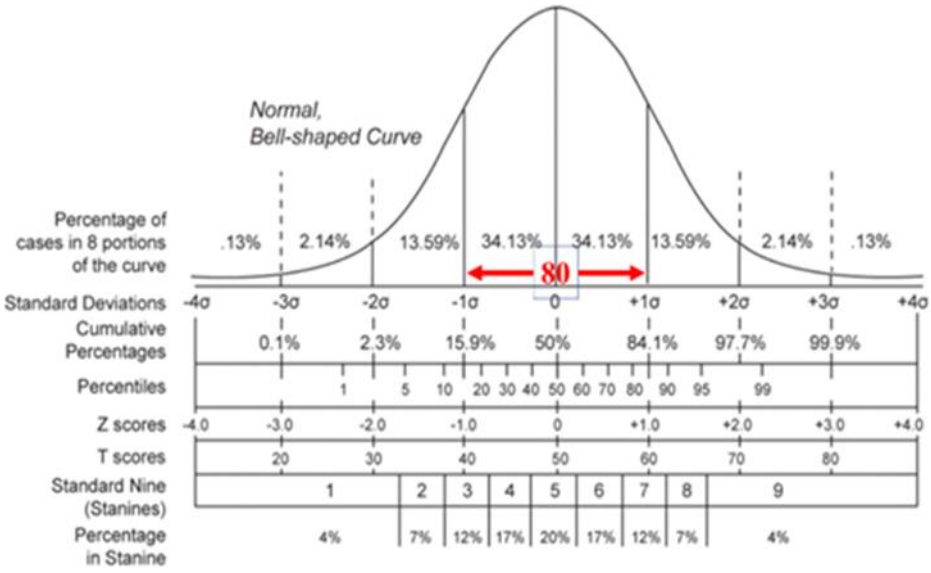
Table 3: standard deviation of Noise in Decibels (dB).

$$\sigma_x = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$$

$$\sigma_x = \sqrt{\frac{1000}{4}} = 15$$

i	x	$(x_i - \bar{x})^2$
1	60	$(60-80)^2$=**400**
2	70	$(70-80)^2$=**100**
3	80	$(80-80)^2$=**0**
4	90	$(90-80)^2$=**100**
5	100	$(100-80)^2$=**400**
$\bar{x}$	80	$\sum(x_i - x)^2$=**1000**

The 15 dB standard deviation in Table 3 is a measure of ensemble dispersion, that is, a measure that indicates how uniform the ensemble data are. The standard deviation demonstrates the distance of the values in relation to the mean of the set, the closer the standard deviation is to 0, the less dispersed are the data of that set.



Graph 1: Noise Gauss Curve in Decibels (dB).

Graph 1 shows the famous Gauss curve, where the central measure of IMPACT NOISE is 80 dB and its dispersion shows that 34.13% plus 34.13%, that is, 68.26% of the set is within this average.

The mean is the reference point (origin) and the standard deviation is the measure of distance from that point (measurement unit). This scale is known as the "z" scale.

$$z = \frac{x - \mu}{\sigma}$$

z = the number of standard deviations from the mean

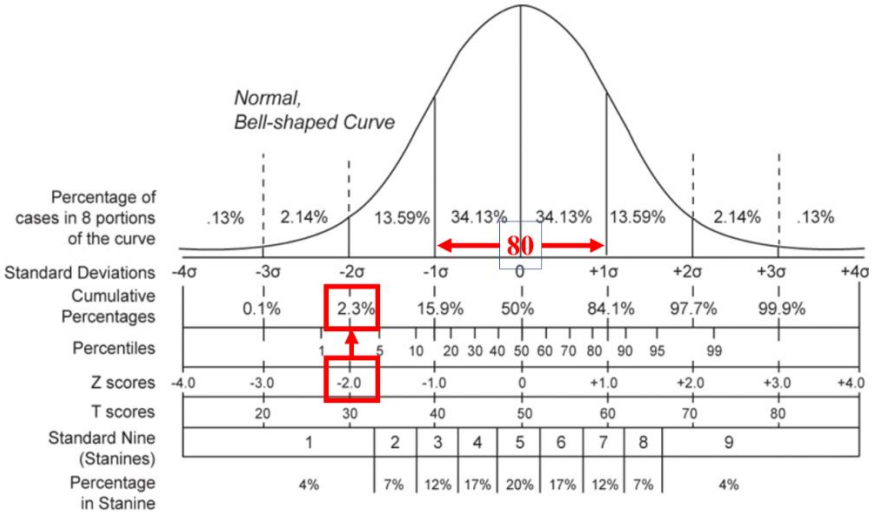
x= arbitrary value

μ = the mean of the normal distribution

σ = the standard deviation

Therefore, the following proposition was put forward: "The average of IMPACT NOISES is 80 dB and standard deviation 15. What is the chance of a person with autism studying in a room that produces less than 49 dB of IMPACT NOISE?

$$z = \frac{49 - 80}{31} = -2$$



Graph 2: Continuous probability distribution of Noise in Decibels (dB).

Graph 2 shows that the probability of a person with ASD entering a room with less than 50 dB of IMPACT NOISE is 2.3%, that is, the chance of being in a healthy environment for their autistic spectrum.

However, for samples of 30 or fewer observations, you should use the "t" distribution which is the correct distribution when using Sx. The values of t in the table are given by n-1, that is, in this case 5 – 1 = 4 and are called degrees of freedom.

The table below lists some selected values for Student's t distribution with (n) degrees of freedom (numbers at the beginning of each row) for the critical regions with one or two tails (one-tailed or two-tailed). In this study, we are doing an analysis where the student's t distribution has 4 degrees of freedom and we want to use a two-tailed 90% confidence level, we look at the table and we see that t must be 2.132.

Table 4: Student's "t"

Unicaudal	75%	80%	85%	90%	95%	97,5%	99%	99,5%	99,75%	99,9%	99,95%
Bicaudal	50%	60%	70%	80%	90%	95%	98%	99%	99,5%	99,8%	99,9%
1	1,000	1,376	1,963	3,078	6,314	12,71	31,82	63,66	127,3	318,3	636,6
2	0,816	1,061	1,386	1,886	2,920	4,303	6,965	9,925	14,09	22,33	31,60
3	0,765	0,978	1,250	1,638	2,353	3,182	4,541	5,841	7,453	10,21	12,92
4	0,741	0,941	1,190	1,533	2,132	2,776	3,747	4,604	5,598	7,173	8,610
5	0,727	0,920	1,156	1,476	2,015	2,571	3,365	4,032	4,773	5,893	6,869

The formula is: $\bar{x} \pm t \frac{s_x}{\sqrt{n}}$, So for 90% confidence the following interval is found: $80 \pm 2{,}132 \frac{15}{\sqrt{5}} = 80 + 14 = 94; 80 - 14 = 66$, that is, between 66 and 94 dB is the true average, so the found average of 80 dB is valid.

Significance testing and estimation are two main branches of statistical inference. The purpose of estimation is to estimate some population parameter. The purpose of significance tests is to decide whether a given statement about a population parameter is true.

The one that suggests that the hypothesis is true is called the null hypothesis and is designated by the symbol H_0; the one that suggests that the statement is false is called the alternative hypothesis and is designated by the symbol H_1. In this study, the average found is 80 dB.

The null hypothesis H_0 is a statement that the population parameter is as specified (true). The alternative hypothesis H_1 s a claim that offers an alternative to the claim (the parameter is greater or less than the claimed value.

A Type I error is committed by rejecting H_0 when H_0 it's true. The probability of a Type I error is equal to the significance level of a hypothesis test. A Type II error is committed by accepting H_0 when it isn't true. This scale is known as the "z" scale.

$$z_{test} = \frac{\bar{x} - \mu_0}{\frac{s_x}{\sqrt{n}}}$$

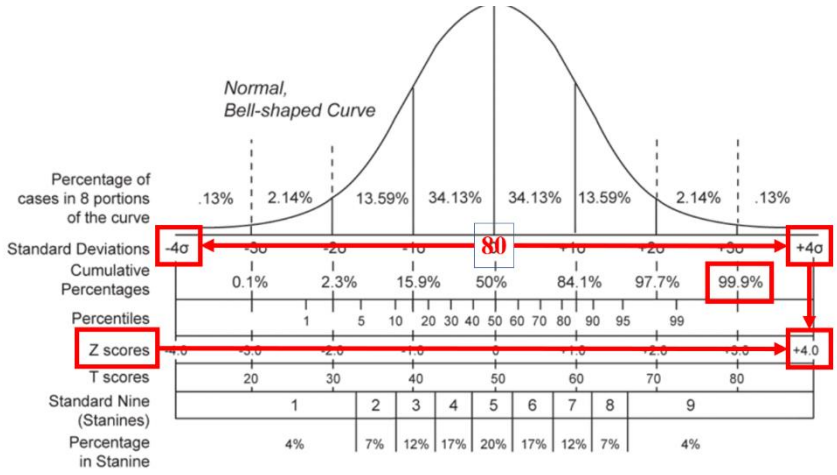
μ_0 = claimed average
$\bar{x}$= sample means
s_x = sample standard deviation
n = sample number

According to the Brazilian Association of Technical Standards (ABNT) the noise limit inside the classroom is 50 decibels.

H_0: p = 50 dB
H_1: p > 50 dB
H_2: p < 50 dB

This study presents a sample of n = 5, with mean = 80 dB and standard deviation of 15 dB. With a 1% risk of rejecting the H_0 , i.e. $\propto$ = 0,01, let's see:

$$z_{test} = \frac{80 - 50}{\frac{15}{\sqrt{5}}} = 4{,}47$$



Graph 3: Noise significance test in Decibels (dB)

Graph 3 demonstrates that H_0: p = 50 dB is not valid. So, the formula is:

$\bar{x} \pm z \frac{s_x}{\sqrt{n}}$

So for 99% confidence the following interval is found:

$80 \pm 2{,}58. \frac{15}{\sqrt{5}} = 80 - 17 = 63$,

i.e. 63 dB, so H_0: p = 50 dB is not valid. The true proposition is:

Thus, it is possible to state that H_1: p > 50 dB, that is, the Brazilian Association of Technical Standards (ABNT) needs to review whether inside the classroom the noise through IMPACT NOISE is still 50 decibels. People with Autistic Spectrum Disorders Are Suffering in These Environments.

7. Conclusion

The person feels overwhelmed by the stimuli they receive and, as they cannot understand the context of the situation, they end up having difficulty organizing their perception and modulating their reaction to them. In the case of fireworks during New Year's Eve, neurotypical individuals (that is, those who are not within the autistic spectrum) understand that they will be fired because it is a social tradition to celebrate the date. When the degree is more

serious, however, the contextualization of situations is very difficult.

Along with the excitement during classes at school, comes the typical noise of students making a racket in the courtyard, in the classroom, or running and screaming in the corridors. It's a natural scenario that hides a serious problem: hearing damage that can start at this stage. It is a fact that joy cannot be repressed, but limits must be imposed. Excessive noise can cause several damages to health, such as stress, lack of concentration and even a progressive hearing loss, which sometimes can only be felt in adulthood, but starts already in the first years of study, amidst the noise in the classroom. classroom and other school environments.

Research carried out by (UNICAMP, 2023) with about 700 students, aged 6 to 14, from municipal, state and private schools in Campinas (SP), found that more than 70% of them are dissatisfied with the noise level in the classroom of class. Furthermore, for 99.2% of these children and adolescents, the biggest sources of noise at school are their peers.

The student noise has a ripple effect. Some shout to make their voices heard over the noise of other students. And the teacher, in turn, is forced to speak even louder in an attempt to make himself understood; not to mention the dragging of chairs and external noise, such as traffic, for example. All this together takes away the concentration of the students, hinders the reasoning and even brings risks to the hearing.

A survey by the Center for the Study of Hearing Disorders, in São Paulo, conducted with 5th grade students, observed that, when exposed to noise, they read faster, place less emphasis on intonation and disrespect punctuation rules. Researchers at the University of Berkeley, in the United States, reached similar conclusions when evaluating the effects of the sound of daytime traffic on 7th grade students: those who study in schools located in areas of intense traffic had worse results in reading tests - a lag seven months - in relation to groups from institutions located in quieter areas. It is necessary to be aware of possible hearing damage, especially in children, which can often go unnoticed. It is necessary to evaluate the hearing of the little ones, mainly at the beginning of the school phase, to avoid learning impairments or even the worsening of existing disorders.

According to the Brazilian Association of Technical Standards (ABNT) the noise limit inside the classroom is 40 to 50 decibels. However, on a daily basis, the noise reaches 80 decibels, especially in classrooms with more than 25 students. In addition, the noise on the patio, at break time, can reach over 100 decibels. The bearable limit for the human ear is 65 decibels, according to the World Health Organization.

The ones who complain the most are the teachers. After years and years of daily exposure to this “deafening noise”, students, professors and employees may have their hearing compromised, as Hearing Loss Induced by High Sound Pressure Levels (HBPHL) has a cumulative effect. The greater the lifetime exposure to noisy environments, the greater the chances of hearing damage.

Contact with very loud sounds causes hair cells, which are inside the ear, to be damaged. These thousands of injured cells can cause tinnitus or the feeling of 'plugged ear'. This sensation usually disappears within 12 hours of exposure to the noise. But if the noise is frequent, the hair cells can degenerate and, as they do not regenerate, hearing loss sets in.

Another survey developed by Wakefield Research for EPIC Hearing Healthcare revealed that 15% of American teachers have hearing loss. Among other professionals, this number did not exceed 12%. The study also showed that the problem mainly affects younger teachers. The rate of hearing loss was 26% among teachers aged 18 to 44 years. Another alarming fact is that 27% of teachers suspect hearing problems but have never sought treatment.

Excessive noise not only harms teachers' hearing, but also their performance as professionals. Often these professionals need to leave due to stress or exhaustion, such as burn out syndrome. That is why specialists warn: Exposure to noise at school, added to the various situations of excessive noise in everyday life – traffic, television at high volume, listening to music with headphones in – is worrying, as it can lead to problems hearing each earlier time.

Among the measures that schools can take in order to mitigate excess noise is to improve the acoustics in classrooms through acoustic insulation, in order to reduce noise reverberation.

Containing excess noise in schools is a very complicated task, but it can be put into practice with awareness campaigns, informative materials and lectures. It is also important that school management promote periodic examinations of students and teachers, intervening early if any problem is identified, even a small one. This serves as a warning and prevents damage to children's learning and teachers' careers.

The work environment can be dangerous for hearing, depending on the professional activity. Therefore, the need for frequent use of personal protective equipment (PPE). However, what is seen in many professions is a lack of awareness of the severity of noise exposure.

Musician, DJ, radio and TV audio operator, music producer, bar/nightclub employee, flight attendant, call center attendant, hairdresser, carpenter, graphics worker, factory worker, jackhammer operator, among many others are exposed to noise. Because of the intense traffic noise, people who work on the streets also often experience noise-induced hearing loss. Among them are police, street vendors, bus and truck drivers, motorcyclists and traffic wardens.

Hearing loss has many impacts on an individual's life. In addition to difficult communication with family and friends and frequent isolation from society, the economic aspect is also a concern. Deafness can make it more difficult to find employment on an equal footing with people of normal hearing.

Young people and adults who usually listen to music with headphones should also be careful because, in this way, the loud sound directly reaches the auditory canal, with risks of hearing loss in the medium and long term, depending on the volume and time of exposure. to noise. Therefore, when looking for a job, they should be aware of possible hearing problems.

Continued exposure to loud sounds can lead to permanent hearing loss. According to the World Health Organization (WHO), sounds above 55 dB (decibels) already present some form of discomfort for human hearing. We don't imagine, but in a normal work environment, like an office, the noise can reach up to 70, 80 dB. Musicians, on the other

hand, have hearing damage with some frequency, as the sound system at concerts, for example, usually reaches 130 decibels.

Contact with high levels of noise can cause increasing damage to hearing, continuously, throughout life. All noise above 85 decibels is harmful to hearing. Many look for specialists due to hearing problems resulting from their profession. Cases of people who triggered hearing loss by exposure to loud noise are common. We also receive in our stores people who work with music who already have hearing loss; and also those looking for a solution to prevent possible damage.

The reality is that many doors have been closed to candidates considered unfit for a job vacancy due to hearing disorders. In our country, the legislation requires that the worker undergo admission exams. Among these exams, the results of audiometry end up being used – contrary to its objective – to select the employee at the time of admission. The result is the existence of a contingent of workers with hearing loss, of the most diverse degrees, who may find it difficult to enter a new job.

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