Improvement Proposal Using Postural Ergonomics And Engineering Design In An Educational Environment: Case Study

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Abstract

The lack of inclusive educational interventions for children with behavioural disorders exacerbates the already concerning problem of school failure in Peru. There is a scarcity of educational proposals that intertwine psychology and engineering, leaving the study of the impacts of postural ergonomics on selective attention unattended despite the frequent mismatch between the furniture and the student's anthropometric measurements. Consequently, this interdisciplinary research, through a case study of Peruvian primary school children disaggregated into ADHD (neurodivergent) and non-ADHD (neurotypical) samples, evaluates the impact of postural ergonomics on selective attention and further assesses the difference between the magnitude of such impact on the neurodivergent and neurotypical samples. The impact assessment is based on the correlation between the d2R test for selective attention results and the evaluation of postural ergonomic correctness. Results from the paired T-test coupled with a Cohen's-D of over 1.95 demonstrate that correct ergonomic posture leads to a significant improvement in selective attention and that such improvement is +1.5 points higher for neurotypicals than for neurodivergents. Ultimately, to provide a tangible improvement to education, and after defining the incoherence between current school furniture and the sample's anthropometric measurements, recommended measurements for adjustable furniture for Peruvian schools that ensure correct postural ergonomics are proposed.

Keywords
Postural ergonomics, Education, Selective attention, ADHD, and Anthropometry.

1. Introduction
In Peru 1 out every 10 children suffer from learning difficulties, and over 75,000 of them have attention-deficit/hyperactivity disorder (Peñahora and Álvarez 2018). In fact, 16% of the 19-year-old Peruvian population has not been able to complete their school studies. Consequently, in 2018 under the law Nº30797 inclusive education was promoted, yet not clear policies have been established (Galarreta and Mantilla 2018).

On the other hand, the incoherence between school furniture and the student's anthropometric measurements is a global issue (Ansari et al. 2018; Carneiro et al. 2017; Gligorović et al. 2018; Lee and Yun 2019; Teferi and Sefene 2021) which jeopardizes both, learning and health, and is extremely pronounced in Peru. In fact, 50% of Peruvian public schools have deficient infrastructure and, due to COVID-19, over 500,000 students have had to transfer from private to public schools just in Lima (ElPeruano 2022). This conundrum is even more alarming as students spend between 70%-90% of their time sitting down (Manca et al. 2020; Prieto-Lage et al. 2021) and it is known that incorrect postural ergonomics predisposes the individual to develop musculoskeletal disorders (Minghelli et al. 2021, Moshki and Mohammadipour 2020) and pain (Carneiro et al. 2017). While ergonomic programs seeking improvement in performance, productivity, competitivity, and security have proven successful, very little attention has been drawn to the educational sector (Fettweis et al. 2013; Smith 2007) and in fact, it has been underestimated by the students and parents themselves (Bakhtiar et al. 2020) .

The problematic that arises from the lack of inclusive education together with incorrect school furniture measurements worsens as there are discrepancies as to the relation between postural ergonomics and its effects on basic cognitive processes. Some investigations indicate that there is no significant impact between concentration, attention, and ergonomics (Gligorović et al. 2018; Keser et al. 2022) while others indicate otherwise (Ehrensberger-Dow 2015; Ansari et al. 2018; Senft et al. 2022;Soltaninejad et al. 2021). Ultimately, this situation stresses the need for an explicative research regarding the impact of postural ergonomics and selective attention within the neurodivergent and neurotypical population in an educational context.

1.1 Objectives

The present study aims to identify the effect of postural ergonomics on selective attention in primary school children between 9 and 13 years-olds and subsequently determine the difference of such effect between the neurodivergent and neurotypical samples. Furthermore, it intends to establish a clear position on the relationship of postural ergonomics and selective attention based solely on the results of the case study. Finally, to provide a tangible contribution to Peruvian public education, measurements in accordance with Peruvian children anthropometric measurements for an adjustable chair and table will be provided with an *a priori* evaluation of the adequacy of the case study's furniture regarding the students' anthropometric measurements.

2. Literature Review

Methods engineering encompass design, formulation, and selection of the best processes to produce a good and/or service. This branch of industrial engineering is based on three pillars: systematic design of workstations, physical factor evaluation, and ergonomic evaluation (Cruz and Garnica 2017). This research focuses on the later and extols it by including psychology's knowledge of cognitive processes. Therefore, being ergonomics and cognitive processes two terms that encompass vast research and theory it becomes key to focus on certain definitions from both disciplines.

Attention Deficit Hyperactivity Disorder (ADHD): is the most common neurobehavioral disorder in children and adolescents (Morrow et al. 2012; Ogundele 2018). ADHD can thus be defined as a neurobehavioral disorder with abnormalities in several neurotransmitter systems, including noradrenergic, serotonergic and dopaminergic systems that is chronic and clinically heterogenous (Efron 2015; Greydanus et al. 2007; Singh et al. 2022). This disorder is linked to poor school performance, with 70% of children with ADHD exhibiting learning difficulties regardless of their IQ, educational service, and socio-economic background (Preston et al. 2009; Singh et al. 2022).

Basic Cognitive processes: the three main cognitive processes are memory, attention, and perception, each affecting academic performance. The process of attention has three dimensions: concentration, divided attention, and selective attention (Porto et al. 2021).

Selective Attention: is part of the attentional process which influences academic performance (Moran 2012; Bouzabou et al. 2021; Cheng et al. 2022; Rajender et al. 2011; Stevens and Bavelier 2012) thus low levels of it can lead to academic failure (Porto et al. 2021). According to the American Psychological Association selective attention is defined as the perceptual ability to focus in one relevant endeavour while ignoring distractions (Moran 2012; Pereira et al. 2021; Preston et al. 2009).

2dr-Test: it's a psychological test that measures selective attention and concentration designed by Brickenkamp, Schmidt-Atzert and Liepmann and should be administered by a registered Psychologist. The test takes approximately 8 minutes to administer and measures selective attention from a cancellation task according to processing speed, following instructions and goodness of performance in the task of discriminating visual stimuli. It is administered to people aged 6 to 80 years.

Postural Ergonomics: is the study of the appropriate conditions to adapt the workspace optimally to the anthropometric characteristics of the user (Peñahora and Álvarez 2018).

Past solutions used to tackle postural ergonomics conundrums in educational institutions usually include furniture prototypes. However, they tend to be based upon the countries' anthropometric mean and not the specific population's mean (Carneiro et al. 2017; Teferi and Sefene 2021) posing a problem as studies demonstrate that ethnicity determines corporal size (Kagawa et al. 2017; Wagner and Heyward 2000) and that there are significant differences in anthropometric characteristics even between adjacent regions (Ball et al. 2010; Chuan et al. 2010; Lin et al. 2004). Moreover, various studies regarding student's postural ergonomics tend to use simple anthropometric evaluation (Baharampour et al. 2013; Castellucci et al. 2010; Parcells et al. 1999; Prieto-Lage et al. 2021; Teferi and Sefene 2021) ; this procedure is based on the fact that each equation is used to compare individually the body dimension of each student with the dimension of the furniture, and proceeds to assess the compatibility of the furniture with the student's measurements (Altaboli et al. 2016). More recently, digital tools have served well for data collection, such as "VICON motion Analyse system" (Mohammadi et al. 2017). Nonetheless, the cost incurred in digital tools tends to deviate researchers from using them and therefore resort to simple anthropometric evaluation.

In the scientific literature, the relationship between postural ergonomics and selective attention remains unclear and research is scarce. For instance, Fettweis (2013) in her study about the effects of improving sitting posture on the student's cognitive process, found that there is in fact a significant improvement in selective attention, audio-verbal memory, visuospatial memory and speed of reasoning. Similarly, Olmos (2020) and García (2022) studies suggest ergonomics' positive impact on ADHD individuals. Indeed, specific correlations are detailed such as the relationship between environmental comfort and learning comfort (Puteh et al. 2015), the relationships of work ergonomics and concentration (Ehrensberger-Dow 2015), study environment and academic performance (Ansari et al. 2018; Senft et al. 2022), and even more precisely, the use of ergonomic chairs and tables and their improvement in the student's posture and performance (Soltaninejad et al. 2021). Notwithstanding, other investigations like those from (Gligorović et al. 2018; Keser Aschenberger et al. 2022) indicate that while ergonomics is related to comfort, this has no impact whatsoever in concentration and attention.

3. Methods

This case study focuses on exploring how postural ergonomics affects selective attention and further seeks to discover if there is a significant difference on the impact's magnitude between the neurodivergent (ADHD) and neurotypical (non-ADHD) population and to ultimately provide guidance on the correct measurements for a Peruvian school furniture. Therefore, using a multidisciplinary approach, this explicative case study utilizes psychology's 2dR Test, that measures selective attention, and Industrial Engineering's foundations on ergonomics and Statistics. The data collection is separated into two key moments: a. the first visit where students will take the 2dR-Test under incorrect postural ergonomics guidelines, b. the second visit (after 7 days) where students will take the 2dR-Test under correct postural ergonomic guidelines.

Sampling:

A non-probabilistic convenience sampling was carried out in a public school in Metropolitan Lima, and a sample of 12 students from ages 9-13 was selected. The sample was divided into two groups, the neurodivergent group that contained 3 boys and 3 girls, and the neurotypical group with the identical composition as the previous one. The student's clinical history where ADHD is certified without any other additional clinical condition was revised in accordance with the Diagnostic and Statistical Manual of Mental Disorders – DSM 5, and the information was provided by the Special Basic Education Centre, with the respective consent of the schoolchildren's parents.

<u>Postural Ergonomic Guidelines:</u>

Using the ANSI/HFES 100-2007 criteria, the OSHA recommendations for prolonged sitting and the report of the European Agency for Safety and Health Work (Peereboom et al. 2021) , and the ISO 24496:2017 standard concerning office furniture Table 1 is obtained, which determines the guidelines that the individual must meet to be considered to have a correct ergonomic posture.

Table 1. Guidelines for defining correct ergonomic posture

Criteria	
1	Torso and neck approximately vertical and aligned (between 90º and 105º degrees to the horizontal)
2	Angle between torso and thigh equal to or greater than 90º
3	The user's back is in full contact with the backrest and contact between the back of the knee and the front of the seat is avoided
4	Uses the full width of the chair to accommodate the hips, including clothing
5	The soles of the feet should rest on the ground
6	The foot forms an angle of approximately 90º with the lower leg
7	The lower leg is in an approximately vertical position
8	Hands and forearms are in straight position
9	The torso is upright

<u>Measurements to be taken:</u>
Firstly, measurements of the classroom's chair and table were taken using Figure 1 as a guideline. Then the popliteal height and hand-elbow reach (Figure 2 shows a visual representation of such anthropometric measurement as A, J respectively) were recorded for each student using a measuring tape together with their standing height.

Figure 1. Furniture measurements to be considered.

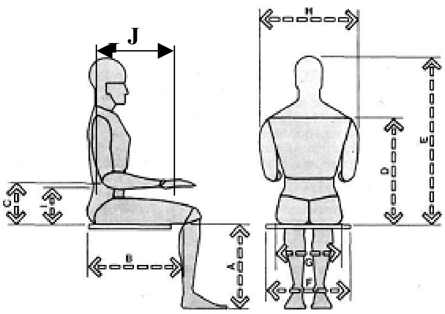

Figure 2. Anthropometric measurements to be recorded visual aid

Step 1-: Determine if there is a mismatch between the classroom's furniture measurements and the sample's anthropometric measurements.
Compare the seat length legs (Figure 1 area labelled AA) with the popliteal height (Figure 2 area labelled A) taking into consideration a $\pm$ 3.8cm tolerance range (Helander 2003), because if the difference is bigger such delta will bound the student to have an incorrect ergonomic posture (Oxford 1969).

Step 2-: Assess selective attention during the first visit and second visit taking into consideration postural ergonomic correctness.
During the first visit, selective attention with incorrect ergonomic posture is assessed. It is imperative to ensure that the sample does not meet the criteria from the "Guidelines for defining correct ergonomic posture" described in Table 1. Then, the professional Psychologist, must proceed to read out loud the d2R test instructions and administer the examination. During the second visit, the procedure outlined above is maintained, yet it must be ensured that the "Guidelines for defining correct ergonomic posture" from Table 1 are being complied to their entirety.

Step 3-: Determine the impact of postural ergonomics on selective attention.
First, Shapiro-Wilk Normality Test will be performed to the data collected in the form of the selective attention scores in the first (P1) and second (P2) visit. Once data normality has been confirmed, a pair T-student test will be performed to determine if correct postural ergonomics in fact affects selective attention and for such the T-paired test results should be less than 0.05 so that the null hypothesis can be revoked. Finally, the intensity of the impact will be assessed using Cohen's D, where 0.8> suggests a strong impact.

Step 4-: Determine the difference between the magnitude of the impact of postural ergonomics between neurodivergent and neurotypical populations.
Repeat step 3, but in this case the Normality Test will have to be performed twice as the data should be divided between neurodivergent and neurotypical sample. Evaluation of the mean score improvement of both groups is also necessary to be able to determine the difference in magnitude that ergonomics has on selective attention between the neurotypical and neurodivergent sample.

Step 5-: Suggesting the correct adjustable measurements for the school's furniture.
The anthropometric principle of design by adjustable range will be followed, as it is recommended by several researchers as ad hoc for furniture (Al-Saleh et al. 2013; Ziefle 2003) and is especially ideal for kids who are constantly growing (Ávila et al. 2007) and even more so when this growth is uneven between sexes (Oxford 1969). Currently, there are no studies published with data of the anthropometric characteristics of Peruvian children, thus, for the calculations the table from Ávila (2007) research of the anthropometric dimensions of the Latin American Population will be used and will ensure that it is suitable for at least 90% of the population and that it complies with Peru's Ministry of Education demands established in the Vici Ministerial Resolution Nº164-2020-MINEDU. For the recommendations to be strictly relevant for the children from the case study, they will be based on anthropometric measures from the average age of the sample which is 11 years old and because girls tend to be taller than boys at such age (Chung and Wong 2007; Ávila et al. 2007) the 5th percentile will come from boys and the 95th percentile from girls. The relevant anthropometric values to be used are shown in Table 2 and Figure 3 provides a visual representation of their meaning. However, as hand-elbow reach (u) could not be found in Ávila (2007) research, using the sample's ratio of $\text{standing hight: hand} - \text{elbow reach}$ the values will be estimated.

Table 3 shows the formulae to calculate the various parts of the furniture shown in Figure 1 in accordance to the children's anthropometric measurements.

Additionally, to calculate the number of levels of adjustment each part of the furniture will need, rounding up is recommended and the following formula should be used:

$$\#\, levels\ of\ adjustment = \frac{Answ_{max} - Answ_{min}}{3.8}$$

It's important to mention that for table thickness (GG), Chair Width (BB), and Chair back width (KK) no levels of adjustment will be provided.

Table 2. Anthropometric measurements to be used for the proposed design of adjustable school furniture taken from (Ávila et al. 2007) research

	5th percentile (cm)	95th percentile (cm)	Range (cm)	Average (cm)
Shoulder Breadth (y)	32.60	46.70	14.10	39.65
Thigh thickness (q)	9.60	15.57	5.97	12.585
Lumbar height (w)	14.10	24.20	10.10	19.15
Popliteal height (z)	33.90	41.40	7.50	37.65
Buttock-popliteal length (t)	35.50	47.40	11.90	41.45
Hand-elbow reach (u)	*	*	*	*
Hip breadth (f)	23.70	35.70	12.00	29.70
Vertical Grip Reach (j)	49.50	64.10	14.60	56.80
Subscapular height (k)	31.80	43.10	11.30	37.45
Standing height	132.50	157.40	24.90	144.95

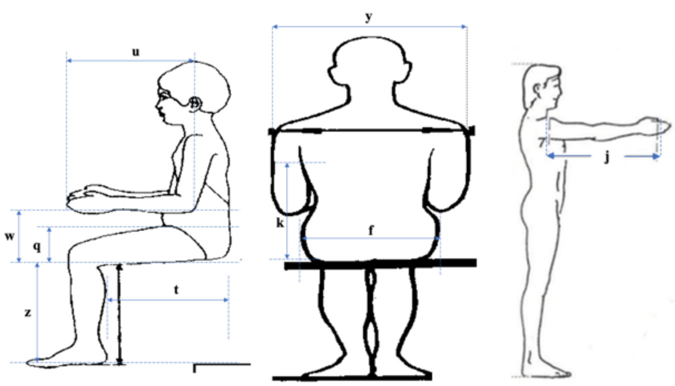

Figure 3. Visual representation of the anthropometric measurements relevant for the investigation's calculations

Table 3. Formulae and measurements to be considered.

<table>
<tr><th></th><th></th><th></th><th>Minimum</th><th>Maximum</th></tr>
<tr><td rowspan="4">Table</td><td rowspan="2">Normal Work Area</td><td>Table Length (FF)</td><td>$cos75º = \frac{FF_{min}}{u_{min}}$</td><td>$cos75º = \frac{FF_{max}}{u_{max}}$</td></tr>
<tr><td>Table Width (II)</td><td>$j_{min} = II_{min}$</td><td>$j_{max} = II_{max}$</td></tr>
<tr><td colspan="2">Table Height (HH)</td><td>$HH_{min} = z_{min} + w_{min}$</td><td>$HH_{max} = z_{max} + w_{max}$</td></tr>
<tr><td colspan="2">Table thickness (GG)</td><td colspan="2">$GG_{min} = HH_{max} - z_{max} - q_{max} - 3^{*}$</td></tr>
<tr><td rowspan="5">Chair</td><td colspan="2">Chair legs height (AA)</td><td>$AA_{min} = z_{min} - chair\ thickness^{**}$</td><td>$AA_{max} = z_{max} - chair\ thickness^{**}$</td></tr>
<tr><td colspan="2">Chair width (BB)</td><td colspan="2">$BB_{max} = f_{max}$</td></tr>
<tr><td colspan="2">Chair depth (CC)</td><td>$CC_{min} = t_{min} - 6^{***}$</td><td>$CC_{max} = t_{max} - 6^{***}$</td></tr>
<tr><td colspan="2">Chair back height (DD)</td><td>$DD_{min} = k_{min}$</td><td>$DD_{max} = k_{max}$</td></tr>
<tr><td colspan="2">Chair back width (KK)</td><td colspan="2">$KK_{max} = y_{max}$</td></tr>
</table>

*The minimum acceptable space between tights and table
**Chair's thickness has been determined to be 3.30cm
***recommended space between the back of the knee and the chair according to Universidad de la Rioja

4. Data Collection

Table 4 and 5 show the anthropometric and furniture data collected on the first visit and all measurements shown are on cm. Table 6 shows the 2d-R test results, where column P1 and P2 contains the first and second visit scores' respectively. From Table 6 it can be easily identified that the second visit's scores are higher and thus leading to infer that correct ergonomic posture indeed leads to better selective attention. Nevertheless, in section 5.4 more precise statistical analysis will be provided.

Table 4. Anthropometric measurements in cm of the sample

Participant	A	B	C	D	E	F	G	H	I	J	K	L
Sex	G	G	G	B	B	B	G	G	G	B	B	B
Age	10	11	11	10	11	11	10	13	12	10	12	11
Weight (Kg)	41	40	40	42	41	41	29	42	40	28	41	41
Type	NT	NT	NT	NT	NT	NT	D	D	D	D	D	D
Standing height	160	131	131	159	132	130	136	165	146	135	164	145
Popliteal height (A)	38	38	38	37	39	37	48	38	42	47	37	41
Hand-elbow reach (J)	30	30	30	29	31	29	29	35	30	28	34	29

NT: Neurotypical, D: Neurodivergent (ADHD), G: girl, B: boy. All measurements are in cm.

Table 5. Furniture measurements in cm

Chair	AA	Height of seat legs	36.00
	BB	Seat width	38.00
	CC	Seat depth	37.00
	DD	Backrest height	36.00
	EE	Desk seat height	27.00
	KK	Backrest width	28.00
Table	FF	Table width	67.00
	GG	Table thickness	17.00
	HH	Table height	64.00
	II	Table depth	47.00
	JJ	Table-chair difference	57.00

Table 6. d2-R Results for Selective Attention

Neurotipicality	**Individual**	**Selective attention**	
		P1	**P2**
Neurotypical	A	91	98
Neurotypical	B	81	90
Neurotypical	C	58	66
Neurotypical	D	82	91
Neurotypical	E	82	89
Neurotypical	F	56	67
Neurodivergent	G	42	52
Neurodivergent	H	38	46
Neurodivergent	I	30	38
Neurodivergent	J	29	36
Neurodivergent	K	31	36
Neurodivergent	L	27	31

5. Results and Discussion

5.1 Numerical Results

Table 7 confirms the furniture's measurement mismatch with the student's anthropometric measures, thus highlighting the urgency of the adjustable furniture measurement recommendations. Furthermore, it is noticeable that this incongruence of measurements particularly affects the neurodivergent group as the average delta of the neurotypical group is 1.83cm whilst for the neurodivergent group is alarmingly 6.17cm almost the doubling the tolerance range of $\pm$ 3.8cm.

Table 7. Results from the determination of the incoherence between school furniture and the student's anthropometric measurements

Participant	A	B	C	D	E	F	G	H	I	J	K	L
Sex	G	G	G	B	B	B	G	G	G	B	B	B
Age	10	11	11	10	11	11	10	13	12	10	12	11
Type	NT	NT	NT	NT	NT	NT	D	D	D	D	D	D
Delta (cm)	2.00	2.00	2.00	1.00	3.00	1.00	12.00	2.00	6.00	11.00	1.00	5.00

NT: Neurotypical, D: Neurodivergent (ADHD), G: girl, B: boy.

5.3 Proposed Improvements

Taking to consideration the proven mismatch between school furniture and the student's anthropometric measurements from Table 7 and the preliminary evaluation that in fact correct ergonomic posture improves selective attention from Table 6, recommended measurements for a school chair and table are displayed in Table 8. The maximum measurement corresponds to a 95th 11-year-old Latin-American girl while the minimum measurement to a 5th percentile Latin-American boy. The number of adjustments ensure that the recommended furniture measurements will adapt to all kids between the 5th-95th percentile. Lastly, the table's last column provides the results of the comparison of the suggested measurements for school furniture for 11-year-olds by Peruvian Ministry of Education (MINEDU) and ours.

Table 8. Recommended measurements for school table and chair for 11-year-old Peruvian students in cm

		Maximum (cm)	**Average (cm)**	**Minimun (cm)**	**# of adjustment levels**	**Size of adjustment level**	**Does it comply with MINEDU's standards?**
Table	Table width (FF)	50.00		43.00	2	3.80	No
	Table thickness (GG)	5.23	3.56	1.50	0	0.00	N.A
	Table height (HH)	65.60	56.80	48.00	3	3.80	Yes
	Table depth (II)	64.10	55.00	45.90	4	3.80	Yes
	Table-chair difference (JJ)	19.70	17.65	12.60			Yes
Chair	Height of seat legs (AA)	41.10	30.60	34.35	4	3.80	Yes
	Seat width (BB)	40.00	*	*	0	0.00	Yes
	Seat depth (CC)	41.40	35.45	29.50	2	3.80	N.A
	Backrest height (DD)	43.10	37.45	31.80	2	3.80	Yes
	Desk seat height (EE)	87.50	65.70	75.10			Yes
	Backrest width (KK)	40.00	*	*	0	0	Yes

The investigation's findings agree with MINEDU's standards in most cases, therefore uncovering an even larger problem: the misuse of MINEDU's guidelines in Peruvian public schools.

5.4 Validation

First, the hypothesis that correct ergonomic posture positively impacts selective attention is tested and confirmed using the data shown in Table 9. Shapiro Wilk Normality Test results demonstrate that the data gotten has a normal distribution, as the p-value gotten is >0.05 and therefore the null hypothesis must be accepted. With such, the T-paired assessment lead as to neglect the null hypothesis as a p-value of <0.01 was gotten which indicated that there is a statistically significant difference between the mean scores of the 2d-R test of the first and second visit; in other words: correct postural ergonomics leads to significantly better selective attention performance. Additionally, Cohen's D was analysed, and as it is bigger than 0.8, it can be inferred that the size of ergonomics' impact on selective attention is actually very strong, which is also reflected on the fact that the mean score average for selective attention from the first visit to the second visit increased by over +7.

Table 9. Data aiding the determination of the impact of postural ergonomics on selective attention.

	p-value (Shapiro Wilk Normality Test)	**Mean Score**	**p-value (T-paired Test)**	**Cohen's D**
Selective Attention Percentile First Visit (P1)	0.051	53.9167	<0.01	1.95982
Selective Attention Percentile Second Visit (P2)	0.087	61.6667		

Lastly, basing our analysis on the data from Table 10, it was discovered that neurotypical's had a higher improvement on their selective attention due to correct ergonomic posture. The normality test undertaken demonstrates that both groups' data, neurodivergent and neurotypical, follow a normal distribution as p-value is >0.05. Similarly, T-paired results demonstrate that correct postural ergonomics implementation in fact positively influences selective attention for both groups, as T-paired results are < 0.01, and therefore the null hypothesis is revoked. Similarly, the intensity of the impact is strong for both groups as both Cohen's D is > 0.80. It's important to note that while on the neurodivergent sample selective attention scores augmented by +7, correct postural ergonomics seems to have had higher influence in the neurotypical group as scores augmented by +8.5. Notwithstanding such discovery, the fact that the neurodivergent group had a +7 improvement in score is extremely substantial and therefore does not diminish the importance of correct ergonomic posture in such population.

Table 10. Data aiding the determination of the intensity of the impact of postural ergonomics between neurodivergent and neurotypical population.

Sample	**Variable**	**p-value (Shapiro Wilk Normality Test)**	**Mean Score**	**p-value (T-paired Test)**	**Cohen's D**
Neurotypical (NT)	*Selective Attention Percentile First Visit (P1)*	1.02	75.0000	<0.01	1.51658
	Selective Attention Percentile Second Visit (P2)	0.085	83.5000		
Neurodivergent (D)	*Selective Attention Percentile First Visit (P1)*	0.268	32.8333	<0.01	2.19089
	Selective Attention Percentile Second Visit (P2)	0.474	39.8333		

6. Conclusion

This case study showcases the richness of interdisciplinary research by utilizing engineering's objectivity and psychology's individual knowledge to tackle one of society's primordial goals: the improvement of *inclusive* education and therefore tackling both groups, neurodivergents and neurotypicals. In fact, the investigation's findings lead as to support the claim that correct ergonomic posture improves selective attention, subsequently aiding to ease the lack of a clear position on the relationship between the previously mentioned variables across the scientific community. Furthermore, while the neurotypical group appears to obtain better selective attention performance scores due to correct ergonomic posture, the neurodivergent group is also significantly beneficiated which in turn guide us to provide a simple, yet effective, engineering-based solution to education by using ergonomics: furniture improvement. The discovery of the furniture's mismatch with the student's anthropometric measurements is an issue that can be found in almost all countries according to scientific literature and this case study was no exemption. However, it is the verification of this research's school furniture recommended measurements with those stipulated by the Peruvian Ministry of Education that uncovered a much deeper conundrum which is not the lack of an incorrect school furniture guidance but the misuse or even worse, the lack of emphasis that public education puts on schoolchildren ergonomics. Ultimately, this investigation intends to highlight such conundrum, calls for the implementation of the advised measurements, and strives to portray the usefulness and value of interdisciplinary research.

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