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SEM Model to Determine the Relationship Between Neurodidactics, Inclusive Education and Sustainability

Antonino Hernández Fernández[1], Claudia De Barros Camargo[2]

[1]*University of Jaen, Spain, antonio.hernandez@ujaen.es, ORCID ID: 0000-0002-7807-4363*
[2]*Autonomous University of Madrid, Spain, ORCID ID: 0000-0002-2286-8674*

ABSTRACT
The research presented here is based on the objective of analyzing whether there is a relationship among neurodidactics, educational inclusion and sustainability in a university context. The starting point was a non-experimental, descriptive, explanatory and correlational research, using an ad hoc Likert scale as a data collection instrument, which has been validated in content and constructs through exploratory factor analysis. The sample consist of 577 participants of undergraduate and graduate students from the University of Jaen (Spain). The results obtained allow us to establish important points for reflection, such as the concept of neurodidactics in the university context, simplified to neurotransmitters, brain areas or multiple intelligences, as well as reducing inclusion to the existence of students with disabilities in the classroom, or to a sustainability that is not considered a driver of change in the current educational system. The conclusion obtained from SEM modeling is the existence of a very strong relationship among neurodidactics and educational inclusion, and the latter with sustainability, while there is a low relationship between neurodidactics and sustainability. Finally, we provide the values that confirm that the proposed model is valid: X2/gl (5.2). IAA: GFI (0.91), RMSEA (0.074), ECVI (1.83). IAI: IFI (0.97), NFI (0.98), RFI (0.96). IP: PNFI (0.78), PGFI (0.65).

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Introduction

The union and intervention of neuroscience with cognitive psychology and pedagogy, to address education, generated the neuro-psycho-pedagogical approach (Paniagua, 2013). Neuroscience offers new models or perspectives to address didactic approaches and interventions that are based "on the design by the teacher of more efficient didactic and methodological strategies, which not only build a "meaningful learning", but also push a cerebral and psychodynamic development. This new approach has been taking shape as a new practical discipline, "based on the science of the brain and the mind: neurodidactics" (Di Gesú, 2017, 17-18). The incorporation of neuroscience is serving to shift from a teaching-centered paradigm to a learning-centered one, and thus build a new approach that would lead to reformulating the educational system (Morales, 2015). This implies moving from a teaching model centered on the teacher to one centered on the student and his or her learning (Barroso, Cabero & Valencia, 2020). In the purely educational context, we have neuroeducation, which in the words of Mora (2013) is to take advantage of knowledge about how the brain works integrated with psychology, sociology and medicine in an attempt to improve and enhance both the learning and memory processes of students and to teach better in teachers. Thus, just as within education we have didactics, within neuroeducation we can establish neurodidactics. Gerhard Preiss and Gerhard Friedrich in 1988, were the first to introduce a course that aimed to put into practice the application of neuroscience knowledge to school teaching, mastering neurodidactics to this subject. Paniagua (2013), refers to neurodidactics as a branch of pedagogy based on neurosciences, which provides a new orientation in education and aims to design more efficient didactic and methodological strategies that promote greater brain development or greater learning. For their part, Román & Poenitz (2018) describe neurodidactics as an area of neuroscience that translates theories and evidence into actions in the classroom. Riaño, Torrado, Díaz & Espinoz (2018) state that the fundamental objective of neurodidactics is to achieve that a learning configuration can be obtained in a way that best fits the brain's development; this must be achieved under the assumption that learning processes model the brain given the surplus of synapses it possesses, so that those that are little used disappear, and the most active ones are reinforced and consolidated; in this way learning will modify our neural networks. Throughout 2019 different types of research focused on neurodidactics emerge, highlighting the one carried out by Benavidez & Flores (2019) that questions whether traditional learning is really meaningful. In 2020 neurodidactics is adjusting to the educational context finding different connections, thus, for García (2020) neurodidactics is the meeting point between learning methodologies and neuroscience. It is to be able to use neuroscience in everyday activities. Phun, Chauca, Curro, Chauca, Yallico & Quispe (2020) show neurodidactics as one of the current supports to the educational process, it is the one that promotes student autonomy to develop self-regulation of their learning by working on their executive functions, suggesting the teacher the use of constant motivation and sensory experience that facilitates neural reconnections, which on the other hand, are the ones that permeate more stable and lasting learning, although adaptable and modifiable. On the other hand, the connection between neurodidactics and attention to diversity, which already existed since 2015, is updated with Justis (2020), whose research argues neurodidactics as the foundation of learning management, specifying that the objective of neurodidactics is to provide answers to the diversity of students from inclusive education, creating synapses, enriching the number of neural connections, their quality and functional capacities through interactions throughout life, organized in a system of pedagogical influences, which determine the creation of neuronal relationships and promote the greatest amount of brain interconnections, generating an ever-increasing potential to achieve quality learning. Specifically, speaking of inclusive education, it is Ocampo (2015) who establishes the first connection between neurodidactics and neurodiversity, providing some evidence. Antón, Madriz & Hidalgo (2016) through the study of communicative competencies try to show the viability of neurodidactics with inclusion. Fernández Palacio (2017) shows some practical strategies to carry out in the classroom, directly applying neurodidactics (boscan, constructive niche, etc.), proposing neurodidactics as an inclusive strategy. In 2018, we find the monograph of the Revista Iberoamericana de educación, whose initial premise is that the gap of 20th-century teachers, who teach 21st-century students with 19th-century techniques, must be broken. This monograph addresses topics such as executive functions, high abilities, assessment, inclusive neurodidactics, neurodidactics of language and literature, gamification, among others (Calatayud, 2018; Falquez & Ocampo, 2018). Subsequently, Urriola (2019) already proposes that teacher training should have neurodidactics as a subject of study. About teaching practice, Phun, Chauca, Curro, Chauca, Yallico & Quispe (2020) say that one of the current supports to the current educational process, is the neurodidactics that promotes the autonomy of the student to develop the self-regulation of their learning working their executive functions, suggesting to the teacher the use of constant motivation and sensory experience that facilitates neuronal reconnections those that permeate a lasting, although adaptable and modifiable. Alarcón (2020) through neurodidactics, scenarios are created that will determine the educational quality which is established in what we want to teach and above all in what teachers are willing to deliver and receive from their students. Finally, Pinto (2021) defends the idea that neurodidactics establishes strategies that the brain uses to learn. Along the same lines, reviewing the master's degrees that have emerged in 2021 on neurodidactics, the topics they address revolve around neurodidactics and education, learning difficulties and disability, emotional education, multiple intelligences, executive functions, emotional plasticity or inclusive education, as a general rule.

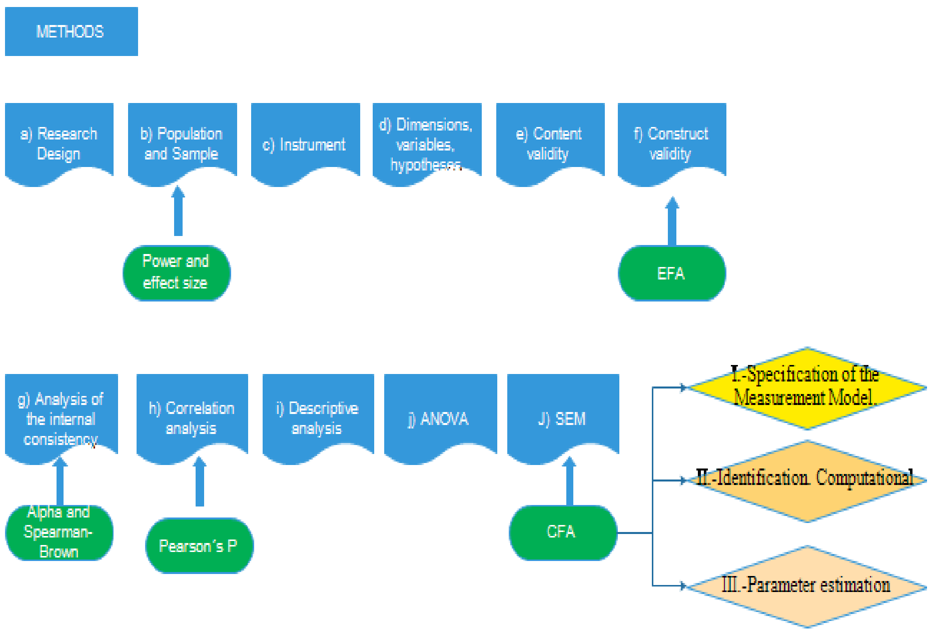
The connection between neurodidactics and educational inclusion, we see that it is established, somewhat superficially, and without really specifying clear and precise neuroscientific methods. In the context of this research, we intend to establish the relationship between these and sustainability, as it refers to the school environment, which must respond to a quality ecology, social sustainability and economic sustainability, following the guidelines of the United Nations, which in 2015 adopted a series of measures in force until the year 2030, known as "Sustainable Development Goals". This agreement is composed of a total of seventeen global goals, to achieve sustainability in a way that is more in line with the current set of problems, one of these goals is that of quality education. According to González (2021), education for sustainable development is an education for the construction of another possible world, in which values such as cooperation, coexistence, common goods, acceptance of diversity as wealth, equity... will be promoted, that is, ecological sobriety in the face of technological drunkenness (Moratalla, 2020). In this way, education is educated for sustainable development, so neurodidactics must be focused, in the same way, on sustainability, which is why the research problem arises: Does the relationship between neurodidactics, educational inclusion and sustainability configure a current educational system, for this we require the use of statistical development to show that this relationship is possible and feasible, so we use SEM structural equation modeling, through a confirmatory factor analysis that allows us to determine not only the relationship between the study dimensions, but also the value of this relationship. In other words, we asked ourselves, is there a relationship between neurodidactics, inclusive education and sustainability, and the hypothesis "There is a statistical way to show this relationship" emerged.

Methods

A flow diagram is shown below, as a guide to the methodological process to be followed in this research.

Figure 1

Research Flow Diagram



The flow chart of the methodological process starts with the research design (a), followed by the selection of the sample from a given population, calculating the power and effect that this sample will have on the research (b). Next, the research instrument is selected (c), the dimensions, variables and hypotheses (d). The research instrument is subjected to content validity (e) and construct validity (f) through Exploratory Factor Analysis (EFA). Reliability is the next phase (g) which is performed by calculating the alpha and the Spearman-Brown coefficient. Correlation analysis (h) will be performed by calculating Pearson's P. Finally, descriptive analysis, analysis of variance (ANOVA) and finally structural equation modeling (j) SEM will be performed through Confirmatory Factor Analysis (CFA).

Research Design

The general objective is to analyze whether there is a relationship between neurodidactics, educational inclusion and sustainability in a university context. To answer this objective, a Likert scale was used as an instrument, and the data were subsequently analyzed with the SPSS v.25 statistical software program. The research is non-experimental (Hernández Sampieri, Fernández & Baptista, 2006), explanatory (Martínez Rizo, 2002), descriptive (Tamayo & Tamayo, 2007), correlational (Buendía, Colás & Hernández Pina, 2010), with a quantitative methodology (Sánchez Flores, 2019). With all of the above, it can be said that, in general, a survey-based research methodology has been used. The survey would be the "research method capable of providing answers to problems both in descriptive terms and in terms of the relationship of variables, after the systematic collection of information, according to a previously established design that ensures the rigor of the information obtained" (Buendía et al., 1998, p.120).

Population and Sample

Concerning the population, we have taken as participants a population of 300 students of the Master's Degree in Compulsory Secondary Education Teaching and 300 students of the fourth year of the Primary Education Degree. These subjects belong to the University of Jaen (Spain) (the academic year 2020/2021), of which 293 Master's degree students and 284 Bachelor's degree students finally responded. The total sample is 577 participants. The most relevant socio-demographic aspects are: in the sample of primary education students, 76% are female, the average age is 19 years old, and the socioeconomic level is medium; in relation to the sample of master's degree students, 73% are female, the average age is 25 years old, and the socioeconomic level is medium.

Statistical Power and Effect Size

In any rigorous study the research must consider the sample size and the statistical power that would be achieved with it (Cardenas & Arancibia, 2014), with this, the G*Power 3.1.9.2 software will be used for the corresponding calculation. First, the type I and type II errors will be determined (figure 2).

Figure 2

Representation of type I and II errors

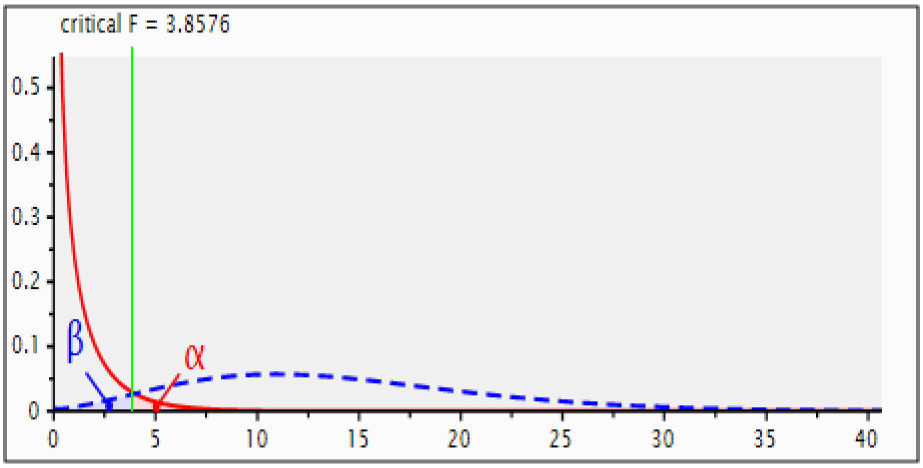


Figure 2 shows error I, which allows us to reject the null hypothesis, and error II, which occurs when there is no effect, and therefore the null hypothesis is accepted; in this case alpha corresponds to error I and beta to error II. The dashed curve presents the sample distribution, the continuous curve the population distribution and the vertical curve the critical points of "F", in this case we have a high probability of accepting the alternative hypothesis (dashed line), being very low the probability of accepting the error I and II. The statistical power of this research is the complement of the type II error probability, that is, the probability of erroneously accepting the null hypothesis (Cohen, 1992). In this case the effect size is: 0.15, critical F is 3.8576, and the power is 0.9491 (94%). Following Cárdenas & Arancibia (2014), the power should be higher than 80%, so the validity of the design cannot be questioned.

Figure 3

Sample and Statistical Power

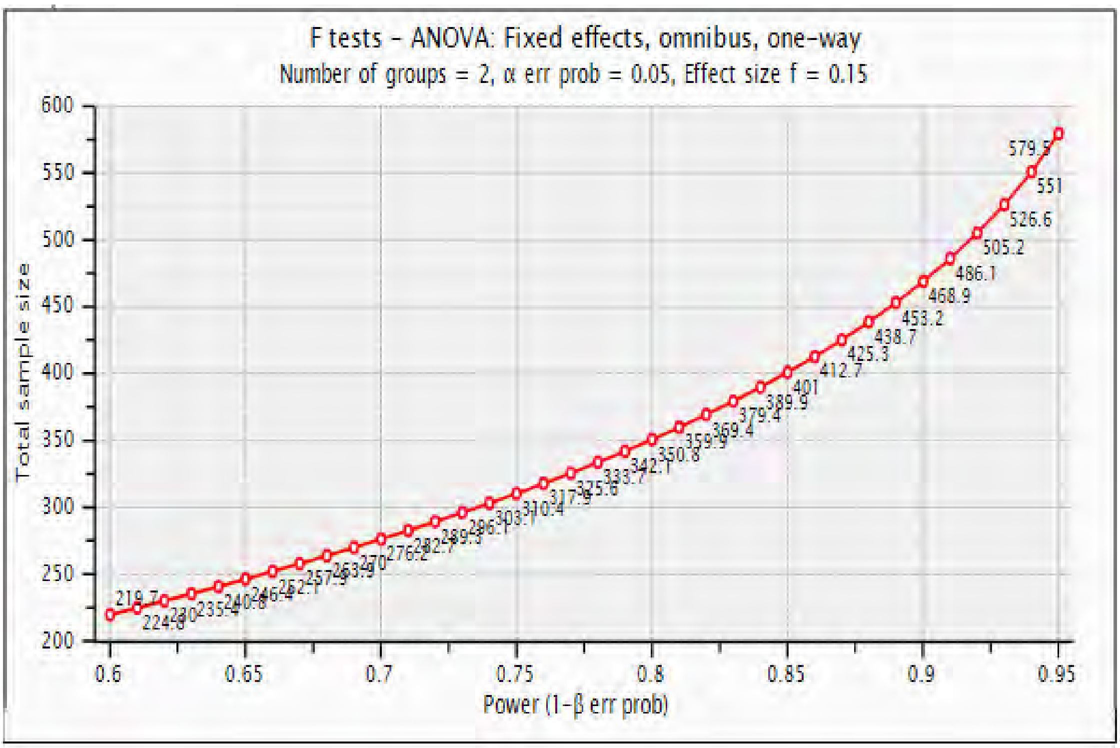


Figure 3 represents the statistical power according to the sample size, showing that as we increase the sample size the statistical power increases, until reaching an excellent value of 0.9491 (94%), which corresponds to the sample of this research.

Instrument

To collect the research data, and operationalization matrix was designed to bring together dimensions, variables and items (Bhushan & Alok, 2017). This operationalization matrix was finally used to construct a Likert scale with a total of 35 items, distributed in three dimensions, and with five response options (Alan & Atalay, 2020).

Dimensions, Variables, Hypotheses

The dimensions are extracted from the corresponding literature review, being the same: A.-Neurodidactics, B.-Educational inclusion and C.-Sustainability. The variables are: neurodidactics, educational inclusion and sustainability as dependent variables, and the sample group as the dependent variable. The hypotheses that arise from the general objective are: H0.-There is no relationship among neurodidactics, educational inclusion and sustainability in a university context, and H1.-There is a relationship among neurodidactics, educational inclusion, and sustainability in a university context.

Table 1

Operationalization Table

Dimensions	Theoretical framework	Items
A.-Neurodidactics	Mora (2013), Garcia (2020)	A1.-Neurodidactics proposes didactic strategies based on neuroscience. A2.-Teaching strategies should be based on each of the brain areas. A3.-A teacher must take into account neurodevelopment and neurogenesis in his/her daily practice. A4.-Knowing the neurotransmitters is key to the teaching process. A5.-Teachers must know the neural networks of reading, writing, calculus... A6.-Synaptic pruning is key in the learning process. A7.-A teacher who, in his or her classroom, fosters attention adds quality to his or her work. A8.-A teacher who, in his classroom, encourages memory adds quality to his work. A9.-A teacher who fosters creativity in the classroom adds quality to his or her work. A10.-Multiple intelligence is key in the teaching-learning process. A11.-Emotional intelligence is key in the teaching-learning process. A12.-Mirror neurons must be taken into account in classroom socialization processes.
B.-Educational inclusion	Justis (2020), Alarcón (2020)	B13.-Integration and inclusion are like terms. B14.-Integration has been overcome in the current educational system. B15.-Inclusion refers to including a student with educational needs in the classroom. B16.-Inclusion is a value system. B17.-Inclusion is achieved when we have inclusive policies. B18.-Inclusion is achieved when we have inclusive teaching practices. B19.-Inclusion is achieved when we have an inclusive society. B20.-Inclusion requires didactics with a neuroscientific basis. B21.-Inclusion must take into account the classroom environment, the social context and its resource viability.
C.-Sustainability	Moratalla (2020), Gonzalez (2021)	C22.-Sustainability and education have little relation. Sustainability in education implies changing the traditional vision of education from the ecological, social and economic points of view. C24.-Sustainability implies that educational inclusion is bearable for the educational system.

	C25.-Sustainability implies that educational inclusion is viable for the educational system. C26.-Sustainability implies that educational inclusion is based on equity. C27.-Sustainability implies that educational inclusion is economically profitable. C28.-Sustainability implies taking care of the educational environment. C29.-Sustainability can be applied to neurodidactics. C30.-Neurodidactics must be in balance between the social, educational and economic context. C31.-Neurodidactics must take care of the educational environment to be sustainable. Neurodidactics must be supportable for the educational system to be sustainable. Neurodidactics must be viable for the educational system to be sustainable. C34.-The neurodidactics must have as base the equitable thing to be sustainable. Neurodidactics must be economically profitable to be sustainable.

Next, the research instrument will be subjected to content and construct validity, and finally its reliability will be determined.

Content Validity

The content validity was carried out using expert judgment and pilot testing. Skjong & Wentworht (2000), and Arquer (1995), as well as their proposal of phases for its realization, have been followed to make the expert judgment. The number of judges was 12 doctors specialized in the subject (Jay & Swerdlik, 2000), the coefficient of expert competence and the analysis of interobserver agreement were calculated. Expert competence coefficient (K): K was calculated from the knowledge coefficient (Kc) and the argumentation coefficient (Ka), obtaining a value of 0.91, which is high (Blasco, López & Mengual, 2010). -Fleiss' kappa: the interobserver agreement analysis was endorsed from the Fleiss' kappa index obtaining a result of 0.940 (Sig 0.000), which corresponds to an almost perfect agreement among the experts. Finally, we conclude that the total content validity of the instrument is 0.92, that is, 92%, so we can move on to the pilot test. The pilot test was conducted by administering the scale to a group of subjects drawn from the sample, and then applying face validity. About face validation (Sánchez & Echeverri, 2010), it was found that 93% of the subjects who participated in this phase found the questionnaire to be clear and accurate, and 97% found it to be comprehensible (mean face validity 95%). Finally, the judges indicated that the scale is coherent, clear and precise, recommending the revision of some terms in six of the items, thus validating the content of the instrument.

Construct Validity

Construct validity was tested with exploratory factor analysis (EFA), following the guidelines of Diaz de Rada (2002). Study of the correlation matrix. The study of the matrix shows a determinant of 8.479E-14, which is very low, which means that there are variables with very high intercorrelations, and it is feasible to continue with the factor analysis. Similarly, Bartlett's test of sphericity has been performed, whose results (595gl, Chi2: 12960.577, sig. 0.05) allow us to continue with the factor analysis process. Regarding the Kaiser-Meyer-Olkin index, the value is 0.910, which is very good and allows us to continue with the analysis. Finally, the diagonal of the anti-image correlation matrix has been studied, showing that the MSA values are high, the minimum value is 0.702 and the maximum 0.837, confirming that we can perform the AFE. Extraction of communalities. The communalities analysis shows that the factors have a value greater than 0.456 so it is not necessary to eliminate any item from the factor analysis. The best-represented items are: A9 (0.867).-A teacher who, in his classroom, encourages creativity adds quality to his work. A5 (0.811).-Teachers should know the neural networks of reading, writing, calculus...The worst represented items are: A8 (0.456).-A teacher who, in his or her classroom, encourages memory adds quality to his or her work. A6 (0.555).-Synaptic pruning is key in the learning process. Factor extraction: Varimax rotation has been used, since we seek to simplify the factors and provide an answer to the factor analysis according to the dimensions being studied, as opposed to other rotations such as quartimax that simplify variables, which is not the objective of this research. Varimax rotation was performed, studying the accumulated percentage, we conclude that the first seven factors explain 70.778% of the accumulated variance (table 2).

Table 2

Total Variance Explained

	Initial eigenvalues			Sums of loads squared by extraction		
Component	Total	% variance	Accumulated	Total	% variance	Accumulated
1	16,042	45,834	45,834	16,042	45,834	45,834
	2,210	6,314	52,148	2,210	6,314	52,148
	1,642	4,690	56,839	1,642	4,690	56,839
	1,361	3,888	60,727	1,361	3,888	60,727
5	1,289	3,683	64,410	1,289	3,683	64,410
	1,212	3,462	67,872	1,212	3,462	67,872
	1,017	2,906	70,778	1,017	2,906	70,778
	0,926	2,646	73,424			

Study of the Factor Scores

Table 3 shows the component matrix, from which the items corresponding to the different factors will be extracted.

Table 3

Rotated Component matrix

	Component						
	1	2	3	4	5	6	7
A1	.743	-.299	.077	.049	.071	.222	-.062
A2	.727	-.211	.353	.017	-.091	.080	-.030
	.760	-.101	.076	-.251	.046	-.050	.343
A4	.702	-.178	.379	-.069	-.106	.086	-.090
A5	.648	-.348	.368	-0.260	.212	-.142	.029
A6	.625	-.131	.024	0.231	-.116	.190	.210
A7	.789	-.123	-.220	-0.162	.000	.009	-.095
A8	.526	.051	-.370	0.047	-.070	.161	.085
A9	.634	-.577	-.191	-0.080	.170	.191	-.153
A10	.760	-.295	-0.098	-0.122	.078	.000	-.065
A11	.708	-.215	-0.315	0.098	-.168	-.054	-.062
A12	.686	-.021	0.359	-0.155	-.021	-.289	.174
B13	.306	.011	.052	.584	.499	.097	.208
B14	.347	.148	.121	-.249	.354	.640	-.158
B15	.623	.040	.366	.022	.172	-.051	-.061
B16	.526	-.165	-.122	.086	-.115	.289	.381
B17	.606	.170	.114	-.069	-.478	.179	-.310
B18	.759	-.011	-.235	-.075	-.202	.101	-.027
B19	.667	-.227	-.299	.007	-.103	-.124	.149
B20	.664	.163	.337	.135	-.186	-.130	-.002
B21	.775	-.132	-.144	-.069	-.035	-.104	-.169
C22	.272	.635	.224	-.099	-.231	.376	.228
C23	.660	-.074	.029	-.289	-.052	-.247	.245
C24	.715	.254	-.072	-.027	.075	-.111	.307
C25	.684	.401	-.236	.091	-.018	-.050	.001
C26	.765	.191	-.186	-.225	-.017	.145	.152
C27	.526	.448	-.208	-.341	.353	-.093	-.188

C28	.740	.172	-.263	-.123	.110	-.144	-.022
C29	.673	.034	-.084	.312	-.040	-.192	-.163
C30	.809	.086	.014	.240	-.112	-.059	-.180
C31	.831	.105	.145	.101	-.158	-.020	-.223
C32	.813	.203	.138	.067	.092	-.145	-.018
C33	.762	-.099	.045	.263	.269	.061	-.075
C34	.764	.131	-.004	.344	-.091	.012	.049
C35	.629	.497	-.021	.026	.275	-.128	-.126

The distribution of items according to the highest level of saturation by factors is shown below, eliminating factors with less than four items (Glutting, 2002).

Items integrated into Factor I. (45.834 % accumulated variance):

Dimension A: A1, A2, A3, A3, A4, A5, A5, A6, A7, A8, A9, A10, A11 A12

Dimension B: B15, B16, B17, B18, B19, B20, B21

Dimension C: C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35

The Cronbach's alpha of Factor 1 was calculated: 0.964 (32 items), an "excellent" rating, confirming that the construct is good.

Analysis of the Internal Consistency of the Research Scale

This analysis will be performed by calculating the internal consistency of halves and intercorrelation of items. Internal consistency of the halves: it is estimated through the Spearman-Brown reliability coefficient (Table 4).

Table 4

Reliability Statistics. Spearman-Brown and Guttman

Cronbach's alpha	Part 1	Value	.919
		N of elements	
	Part 2	Value	.934
		N of elements	
	Total N of elements		
Correlation between forms			.849
Spearman-Brown	Equal length		.918
Coefficient	Uneven length		.918
Guttman coefficient of two halves			.917

The Guttman two-half coefficient is 0.917, which means that the data are reliable, due to its proximity to 1. Internal consistency of intercorrelation of items: it is analyzed through the Cronbach's Alpha coefficient which shows a good internal consistency of the set of the 35 variables since it presents a value of α =0.959 (Table 5).

Table 5

Cronbach's Alpha

Cronbach's alpha	N of elements
.959	

Finally, Cronbach's alpha was calculated for each dimension (Table 6). Dimensions A and C show excellent reliability; however, dimension B shows acceptable reliability.

Table 6

Reliability of the Dimensions

Dimensions	Cronbach's alpha
A (Neurodidactics)	.922
B (Educational inclusion)	.799
C (Sustainability)	.923

Correlation Analysis

To perform the correlation, the Likert scale is subjected to the Mann-Whitney U test for two independent samples, which shows that the data follow a normal distribution, so Pearson's P correlation must be used (Hernández Sampieri, Fernández, & Baptista, 2006). The items with significant correlation are the following:

-Dimension A (Neurodidactics): A1>A2 (0.550), A2>A1 (0.550), A3>A4 (0.553), A5>A4 (0.591), A6>A1 (0.470), A7>A8 (0.525), A8>A7 (0.525), A9>A11 (0.554), A10>A4 (0.557), A11>A9 (0.554), A12>A5 (0.587)

-Dimension B (Educational Inclusion): B13>C33 (0.375), B15>C32 (0.534), B16>C26 (0.409), B17>C31 (0.560), B20>A12 (0.593), B21>C23 (0.476)

-Dimension C (Sustainability): C23>C28 (0.509), C24>C26 (0.552), C25>C24 (0.508), C26>C24 (0.552), C27>C35 (0.583), C28>C23 (0.509), C29>C30 (0.582), C34>C31 (0.563), C35>C27 (0.583)

The items with the highest significant correlations are:

A4>A2 (0.637) A4◎.-Knowing the neurotransmitters is key to the teaching process. A2.-Teaching strategies should be based on each of the brain areas.

B18< >B19◎(0.614) B18.-Inclusion is achieved when we have inclusive teaching practices. B19.-Inclusion is achieved when we have an inclusive society.

C30< >C31◎(0.693) C30.-Neurodidactics must be in balance between the social, educational and economic context. C31.-Neurodidactics must take care of the educational environment to be sustainable.

C32< >C33◎(0.649) C32.-Neurodidactics must be supportable for the educational system to be sustainable. C33.-Neurodidactics must be viable for the educational system to be sustainable.

The items with the lowest correlation are:

B14>C26 (0.316) B14◎.-Inclusion has been surpassed in the current educational system. C26.-Sustainability implies that educational inclusion is based on equity.

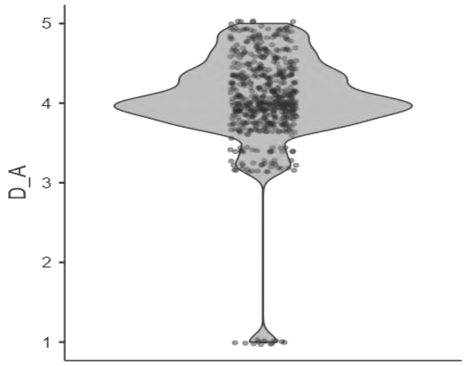
C22>B17 (0.343) C22◎.-Sustainability and education have little relation. B17.-Inclusion is achieved when we have inclusive policies.

Descriptive Analysis

Regarding the descriptive analysis, we will highlight, by dimension, the responses of the research subjects that are relevant to appreciate the ideas of the sample group on the subject under investigation. Dimension A (Neurodidactics): the subjects express "agreement" (mean=4.0286) (figure 4) in general terms with this dimension. Specifically, they agree that teaching strategies should be based on brain areas, that a teacher should take into account neuronal development and neurogenesis in his or her daily practice, or know the neurotransmitters in the teaching process, among others.

Figure 4

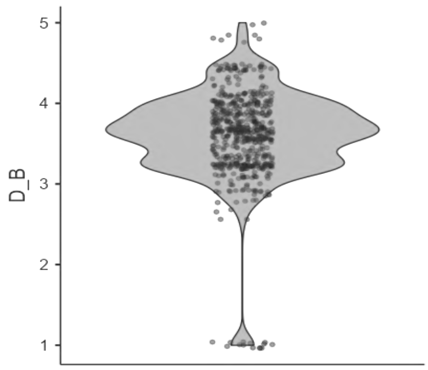
Descriptive Data of Dimension A



Dimension B (Educational inclusion) participants are generally "indifferent" (mean=3.5968) (figure 5). However, there is a lot of variability in the answers, so participants are indifferent to the fact that inclusion refers to including a student with educational needs in a classroom, that inclusion is a system of values, that inclusion is achieved when we have inclusive policies or that inclusion needs a didactic with a neuroscientific basis. They agree that inclusion is achieved when we have inclusive teaching practices, when we have an inclusive society. However, they disagree that integration and inclusion are similar terms, or that inclusion has been overcome in the current educational system.

Figure 5

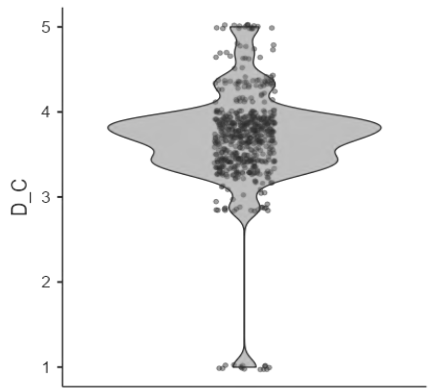
Descriptive Data for Dimension B



Dimension C (Sustainability) subjects respond "indifferent" (mean=3.6826) (figure 6) in general. However, variability in the answers must be highlighted, thus, the subjects are indifferent about whether sustainability implies that inclusion is bearable by the educational system or that inclusion is economically profitable, or that sustainability can be applied to neurodidactics, or that the latter is profitable. They disagree that sustainability and education have little relation. Finally, they agree that sustainability implies taking care of the educational environment, sustainability implies that inclusion is viable for the educational system, sustainability implies changing the traditional vision of education from an ecological, social and economic point of view.

Figure 6

Descriptive Data for Dimension C



Analysis of Variance (ANOVA)

ANOVA is performed to analyze whether there are statistically significant differences between the samples of the two groups. Table 7 shows the calculation of Fisher's F which shows us that, the strongest relationship is between: Grade/Master and Dimension A (F=58.429), Grade/Master and Dimension B (F=9.025) and finally, Grade/Master and Dimension C (F=15.901). The strongest relationship is between neurodidactics and degree/master's degree, with a difference from the rest of the dimensions, with which, there are significant differences in the answers given by both groups in relation, above all, to neurodidactics, somewhat less about sustainability.

Table 7

ANOVA

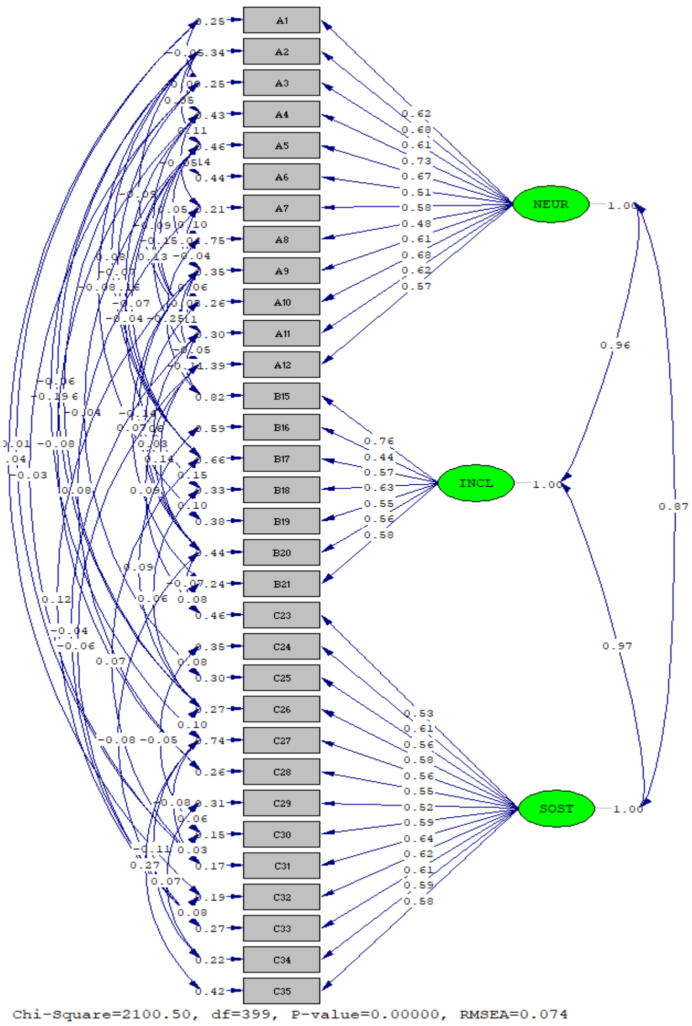
		Sum of squares	gl	Root mean square	F	Sig.
Dimension A	Between groups	21.651	1	21.651	58.429	0.000
	Within groups	213.071	575	0.371		
	Total	234.723	576			
Dimension B	Between groups	3.080	1	3.080	9.025	0.003
	Within groups	196.212	575	0.341		
	Total	199.292	576			
Dimension C	Between groups	5.520	1	5.520	15.901	0.000
	Within groups	199.605	575	0.347		
	Total	205.125	576			

Confirmatory Factor Analysis

The SEM methodology consists of a series of phases according to Kaplan (2000) & Kline (2005) that we will specify in four. I.-Specification of the Measurement Model. The scale with 32 observed variables will be used for the structural study. II.-Identification. Computational implementation of the system of structural equations. The degrees of freedom are 399, being the model over-identified. III.-Parameter estimation. Figure 7 shows the five latent variables (constructs) and the 32 observed variables (obtained from the AFE), which together make up the dimensionality of the instrument.

Figure 7

Graphical Representation of the Natural Measurement Model of the Likert Scale



As for the regression coefficients between the latent and observed variables, the interpretation is as follows.

Dimension A (Neurodidactics):

Greater influence of the latent variable on:

A4 (0.73).-Knowing the neurotransmitters is key to the teaching process.

A2 (0.68).-Teaching strategies should be based on each of the brain areas.

A10 (0.68).-Multiple bits of intelligence are key in the teaching-learning process.

Less influence of the latent variable on:

A8 (0.48).-A teacher who, in his classroom, encourages memory adds quality to his work.

Dimension B (Educational inclusion)

Greater influence of the latent variable on:

B15 (0.76).-Inclusion refers to including a student with educational needs in the classroom.

Less influence of the latent variable on:

B16 (0.44).-Inclusion is a value system.
Dimension C (Sustainability):
Greater influence of the latent variable on:
C31 (0.64).-Neurodidactics must take care of the educational environment to be sustainable.
C32 (0.62).-Neurodidactics must be supportable for the educational system to be sustainable.
Less influence of the latent variable on:
C29 (0.52).-Sustainability can be applied to neurodidactics.
C23 (0.53).-Sustainability in education implies changing the traditional vision of education from the ecological, social and economic points of view.
The strongest relationship between the latent variables is given by:
Neurodidactics - Educational Inclusion (0.96)
Educational Inclusion - Sustainability (0.97)
The lowest ratio is given by:
Neurodidactics - Sustainability (0.87)
IV.-Evaluation of the adjustment. Application of goodness-of-fit indexes and criteria.
At this stage we use indices and goodness-of-fit criteria to relate the validation evidence to the dimensional structure of the instrument being evaluated, which in our case is acceptable: X2/gl (5.2). IAA: GFI (0.91), RMSEA (0.074), ECVI (1.83). IAI: IFI (0.97), NFI (0.98), RFI (0.96). IP: PNFI (0.78), PGFI (0.65).

Table 8

Goodness-Of-Fit Indices

	X^2/gl	GFI	RMSEA	ECVI	IFI	NFI	RFI	PNFI	PGFI
Actual value	5.2	0.91	0.074	1.83	0.97	0.98	0.96	0.78	0.65
Ideal value	p<5	>0.90	<0.08	>value	>0.95	>0.95	>0.95	0.06 a 0.09	> value

Table 8 shows the real value and the ideal value, following Levi, Varela & Abad (2006), showing that the criteria of all the goodness-of-fit indices are met, so that the model is fully confirmed.

Discussion

The results of this research were based on a quantitative methodology, thus attempting to respond to the objective, hypothesis and research problem. We highlight the suitability and power of the selected sample, to which an ad hoc Likert scale with three dimensions and 35 items was applied, showing excellent reliability. The content validity is very good, and as a result of the FEA carried out, we can advance some interesting results, thus, a teacher who promotes creativity in the classroom or who knows the neural networks are the ideas with the greatest weight on the scale, however, the fact that a teacher promotes memory or takes into account synaptic pruning in the learning process hardly has any weight. Finally, the scale has construct validity, with a reduction of three items, and somewhat better reliability. The correlation analysis shows that teachers need to know the neurotransmitters as well as the corresponding brain areas, that inclusion is achieved when we have inclusive teaching practices and when we have an inclusive society, and vice versa. And, finally, that neurodidactics must be bearable and viable for the educational system if it is to be sustainable. Regarding the descriptive analysis, the participants have an attitude of agreement with what neurodidactics represents in the educational center, while they are indifferent to educational inclusion and sustainability. It should be pointed out that on some issues they do agree, such as the need for inclusive practices and society to achieve educational inclusion, or that sustainability implies changing the traditional view of education from the ecological, social and economic point of view, as well as that inclusion is viable for the educational system. About the differences between the groups, the Anova shows that the group responds more cohesively to the items on neurodidactics than to the rest of the dimensions. Finally, the structural equation modeling (SEM) carried out allows us to obtain conclusive results, thus, neurotransmitters, brain areas and multiple intelligences are key in neurodidactics. In educational inclusion, the most important thing is to include a student with special educational needs in a classroom, but the inclusion of a value system is not. And finally, about sustainability, the most important thing is to take care of the educational environment and make it bearable for the educational system, the least important thing is that it can be applied to neurodidactics or change the traditional vision of education. With all this, the final result obtained from SEM modeling is the existence of a very strong relationship between neurodidactics and educational inclusion, and this with sustainability, while there is a low relationship between neurodidactics and sustainability. The values obtained in the development of the confirmatory factor analysis: absolute fit indexes: GFI (0.91), RMSEA (0.074), ECVI (1.83); relative fit indices: IFI (0.97), NFI (0.98), RFI (0.96), and parsimony indices: PNFI (0.78), PGFI (0.65), allow us to diagnose the SEM model to determine if the model is correct and serves as an approximation to the real phenomenon. The measures we have used are the absolute measures of fit, the incremental fit measures and the parsimony measures. The residuals of the root mean square, and the expected cross-validation index, show that the SEM model has an optimal fit. The normalized fit index and the relative fit index show a SEM model with a good incremental fit, so this model can be compared with similar models. The normalized fit index and the goodness-of-fit index indicate a very good parsimony of the model, so we can say that the number of parameters used for the construction of the model is correct. With everything expressed above, we proceed to review the confirmation status of the hypotheses raised, being able to say that the null hypothesis can be discarded, and accept the alternative hypothesis, so there is a very strong relationship between neurodidactics and educational inclusion, and of this with sustainability. Thus, we agree with Di Gesú (2017) that neurodidactics serves to change the traditional landscape of education. On the other hand, the teaching process must take nuance not only sustainable, but truly scientific (Barroso, Cabero, Valencia, 2020). The idea that neurodidactics is a key support for educational inclusion and sustainability is thus confirmed (Phun, Chauca, Curro, Chaca, Yallico, & Quispe (2020). For now, the analysis of the results allows us to establish important points for reflection, such as the concept of neurodidactics in the university context, reduced to neurotransmitters, brain areas or multiple intelligences, as well as reducing inclusion to the existence of students with disabilities in classrooms, or to sustainability that is not considered a driver of change in the current educational system. The influence of educational inclusion on both neurodidactics and sustainability has been demonstrated, and there should also be an influence between neurodidactics and sustainability. These ideas are a counterpoint to those expressed by Mora (2013), Justis (2020), or González (2021), since neurodidactics is reduced in its content when we are in educational environments, without becoming the foundation of learning management, and being the engine of response to student diversity, and finally, it is not perceived in the participants that sustainable development generates another possible world.

Conclusion and Implications

The investigation of the problem was carried out because of the interest in finding out if and to what extent there is a relationship between neurodidactics, educational inclusion and sustainability, since we hardly found studies where relationships between some of them are mentioned in any way, but there is, so far, no research that analyzes the existing links between the three elements. In conclusion, it is confirmed, through SEM methodology, a model that shows the relationship and the existing strength between the three areas, being of great interest for the academic and professional context, firstly, from neurodidactics we expect methodologies that favor the inclusion of students with specific educational support needs, and from educational inclusion we expect it to contribute to sustainability, providing equitable, viable, economically profitable and caring responses to the educational environment. Finally, the low relationship between neurodidactics and sustainability makes us think of increasing research to generate neurologically-based didactic strategies that help in the sustainability of the educational system. The contribution that we highlight from this research is the idea that although it is demonstrated that there is a relationship between neurodidactics, sustainability and educational inclusion, from the point of view of our schools, training in neurodidactics is necessary to give a scientific character to the actions on educational inclusion and sustainability that can be done in the day to day of the schools.

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