Estimation of university students' autonomy, its relationship with academic performance, and the validity of the measurement instrument

María Cristina Gamboa Mora[*]

Vicky Ahumada[**]

Anamaría Montes Gamboa[***]

Abstract

Objective. To estimate the level of autonomy among university students in virtual distance learning environments. **Method.** Descriptive, analytical, and correlational educational research was conducted using a sample of 430 students. The Autonomy Level Scale, consisting of 67 Likert-type items across 7 dimensions, was validated by calculating Cronbach's alpha, Rasch model analysis (Infit

[*]Doctora en Innovación e Investigación en Didáctica. Docente Asociado de la Escuela Ciencias de la Educación. Líder del grupo de investigación interinstitucional AMECI, avalado por la Universidad Nacional Abierta y a Distancia (UNAD) y la Universidad Distrital Francisco José de Caldas (UDFJC); reconocido y categorizado en A1, por MinCiencias. Promueve investigación en el área de la didáctica de las ciencias, la gestión de la sostenibilidad y la ambientalización curricular. Investigadora Sénior.
Correo electrónico: maría.gamboa@unad.edu.co
ORCID: https://orcid.org/0000-0001-8459-099X;

[**]Doctor en Educación NOVA Southeastern University – EE. UU, Magíster en Administración y Supervisión Educativa U. Externado de Colombia, Especialista en Pedagogía para el Desarrollo del Aprendizaje Autónomo y Licenciada en Ciencias de la Educación U. del Atlántico. Docente de la Escuela Ciencias de la Educación en la UNAD. Investigadora del Grupo Ambientes de Enseñanza Aprendizaje de las Ciencias Básicas (AMECI), categorizado A1 por MinCiencias, Investigadora Junior.
Correo electrónico: vicky.ahumada@unad.edu.co
ORCID: https://orcid.org/0000-0002-8797-331X

[***]Profesional en Estadística de la Universidad Santo Tomás. Prestadora de Servicios de apoyo para la integración de tablas de datos, construcción de diccionarios de datos, revisión de metadatos, disposición de insumos para el uso de análisis, modelamiento, y generación de visualizaciones estadística del Observatorio Inmobiliario Catastral (OIC) en la Dirección de Investigación y Prospectiva (DIP) del Instituto Geográfico Agustín (IGAC). Investigadora del Grupo (AMECI).
Correo electrónico: anamariamontes@usantotomas.edu.co
ORCID: https://orcid.org/0009-0005-7260-991X

and Outfit), and Confirmatory Factor Analysis to determine each item's contribution. Individual autonomy scores were assigned using the Rasch model. Academic performance was measured via average final grades. **Results.** The Spearman correlation showed that 16 scale items had a positive correlation between autonomy perception and academic grades. The instrument showed overall reliability, although some items required adjustment to better assess average and extreme values. Additionally, 44.88% of students were classified as autonomous. **Conclusion.** The Autonomy Level Scale is a reliable tool for measuring autonomy in university students in virtual education, with some recommendations for item modification to improve accuracy.

Keywords: Autonomy, reliability, distance education, measurement instrument, academic performance.

Estimación de la autonomía de estudiantes universitarios, su relación con el rendimiento académico y la validez del instrumento de medición

Resumen

Objetivo. Estimar el nivel de autonomía entre estudiantes universitarios en entornos de educación virtual a distancia. **Método.** Se realizó una investigación educativa descriptiva, analítica y correlacional con una muestra de 430 estudiantes. La Escala de Nivel de Autonomía, con 67 ítems tipo Likert distribuidos en 7 dimensiones, fue validada mediante alfa de Cronbach, análisis con el modelo Rasch (Infit y Outfit) y un Análisis Factorial Confirmatorio.

Se asignaron puntuaciones individuales usando el modelo Rasch. El rendimiento académico se midió con las calificaciones promedio finales. **Resultados.** El coeficiente de Spearman mostró que 16 ítems presentaron correlación positiva entre la percepción de autonomía y las calificaciones. El instrumento resultó fiable en general, aunque algunos ítems requieren ajuste para evaluar con precisión valores cercanos a la media y extremos. Además, el 44.88% de estudiantes fue clasificado como autónomo. **Conclusión.** La Escala de Nivel de Autonomía es una herramienta confiable para medir la autonomía en estudiantes universitarios en educación virtual, con recomendaciones para ajustar ciertos ítems para mejorar la precisión.

Palabras clave: Autonomía, confiabilidad, educación a distancia, instrumento de medida, rendimiento académico.

Estimativa da autonomia de estudantes universitários e sua relação com o desempenho acadêmico

Resumo

Objetivo. Estimar o nível de autonomia entre estudantes universitários em ambientes de educação virtual a distância. **Método.** Foi realizada uma pesquisa educacional descritiva, analítica e correlacional com uma amostra de 430 estudantes. A Escala de Nível de Autonomia, composta por 67 itens do tipo Likert distribuídos em 7 dimensões, foi validada por meio do alfa de Cronbach, análise com o modelo Rasch (Infit e Outfit) e Análise Fatorial Confirmatória. As pontuações individuais foram atribuídas usando o modelo Rasch. O desempenho acadêmico foi medido pelas notas médias

finais. **Resultados.** O coeficiente de Spearman indicou que 16 itens apresentaram correlação positiva entre a percepção de autonomia e as notas acadêmicas. O instrumento apresentou confiabilidade geral, embora alguns itens precisem de ajustes para avaliar adequadamente valores próximos à média e extremos. Além disso, 44,88% dos estudantes foram classificados como autônomos. **Conclusão.** A Escala de Nível de Autonomia é uma ferramenta confiável para medir a autonomia em estudantes universitários na educação virtual, com recomendações para ajustes em alguns itens visando melhorar a precisão.

Palavras-chave: Autonomia, confiabilidade, educação à distância, instrumento de medição, desempenho académico.

Introduction

In Colombia, higher education faces several challenges related to learning quality, student retention, and academic performance. A common critical element identified in various studies is the limited autonomy of university students in managing their own learning processes (Afacan & Gülbahar, 2023; Muhammad, 2020; Canova & Pecker, 2019; Oveshkova, 2018; Zhong, 2018). During the transition from secondary to higher education, cognitive demands are greater; however, the persistence of traditional pedagogical approaches— focused primarily on content transmission and the teacher's role as the primary source of knowledge— act as barriers to the development of autonomy. Nevertheless, in light of increasing digitalization and globalization, autonomous learning has become a fundamental requirement for students' academic and professional success, and when such autonomy is not developed, students' academic performance and even their persistence within the educational

system may be jeopardized, particularly in contexts of high social and economic vulnerability (Ahumada *et al.*, 2024).

International literature has demonstrated a positive relationship between autonomy and academic performance. However, in the Colombian context, Ahumada *et al.* (2024) note that most studies on this topic remain descriptive, overlooking dimensions related to decision-making, vocational orientation, motivation for career choice, professional guidance, self-planning and identification of learning goals, academic commitment, control and self-regulation, collaboration in academic environments, among others. As there is also a lack of comparative research between public and private universities, in this study, two universities from each category that offer virtual learning programs are examined. These gaps in Colombian literature justify the interest to investigate student autonomy in higher education and its relationship with academic performance, in order to better understand the factors that facilitate or limit its sustained development over time.

From a general perspective, autonomy is configured as those actions that are performed willingly, in response to personal interest and without external impositions Ramón (2019) to self-determine and shape the individual's life, and from the student's perspective, autonomy is identified as the capacity for the development of thinking, improvement of feeling and decision making by oneself López, *et al.* (2021) and authors such as Cárcel (2016) propose a definition of autonomous learning as a succession of events that involve activities carried out independently, stating that "it is a process that allows the subject to be the author of his own development, choosing paths, strategies, tools and moments that he deems appropriate to learn and put into practice independently what he has learned" (p. 102), likewise, Peña and Cosi (2018) emphasize the student's self-regulation from a critical perspective and Rué (2009) exposes that autonomous learning reflects the student's position regarding his decision to learn

and decomposes the process, since: 1) it is oriented to respond to the knowledge demands designed by the teacher, 2) it appropriately and pertinently defines the contexts and 3) it responds to the conditions of knowledge management.

From a social cognitive point of view, Zimmerman (2001) indicates that autonomy is a quality that enables change and innovation of the human being, always in a positive projection, adapting and interacting constructively in different environments. It is thus associated with self-regulation, metacognition, and self-efficacy. In the university context, this translates into a student who assumes an active role in their learning, identifies their strengths and weaknesses, and employs the most effective strategies according to their pace and learning style to achieve their goals.

In addition, social perspectives contribute to the understanding of autonomy by linking social interaction and educational context as influencing factors. For Vygotsky (1978), learning is constructed in collaboration with others through language, cultural mediation, and participation in communities. Consequently, autonomy is not an individual process but rather a construction that emerges from dialogue, cooperation, and belonging within an academic environment. Building on these theoretical standpoints, academic autonomy constitutes an essential competence in university education, as it links the student's ability to direct their own learning process, make informed decisions, and assume responsibility for their academic development within a framework of collective knowledge construction.

The results of studies on autonomy perceptions have suggested that students' academic performance in virtual education is related to their perceptions, their degree of satisfaction and the persistence they exhibit when they remain active in the system (Caballero, *et al.*, 2023; Cruz, *et al.*, 2019). Students initiate their learning processes based on personal decision making and their experiences Oveshkova

(2018); Viana, *et al.* (2017); however, in some cases they positively or negatively value their autonomy or feel more confident if they receive academic and technological support from the institution (Carreño, *et al.*, 2020). According to Acosta (2020), perceptions of autonomy are related to the awareness of the ability to make decisions that allow regulating one's own learning in order to bring it closer to a certain goal under specific conditions.

Afacan and Gülbahar (2023) point out that students in virtual education must be aware of the demands of the chosen program such as the curriculum methodology and the evaluation system; depending on the level of autonomy of the students, so will be the effects on their learning and, consequently, on their academic performance. The perception of autonomy as a construct is associated with the self-referential processes of individuals as one of the dynamic systems of personality along with the emotional and motivational systems (Díaz, *et al.*, 2022; Canova & Pecker, 2019). The self-concept is the individual's perception of himself as a product of his individual experiences, social and capabilities that structure his own behavior shaping a set of attitudes, feelings, appearances, social acceptance and knowledge Muhammad (2020); Zhong (2018), and thus individuals can build concepts about their own capabilities and of the actions of others.

From their perspective, students identify their academic development, the personal and institutional components that evidence their satisfaction in virtual settings, across different formative processes such as induction, support, and autonomy strengthening. By directly participating in program selection, as highlighted by Deroncele *et al.* (2021), students recognize that factors such as attitude, motivation, or personal interest directly affect their persistence or development of interest in their studies, which can be at a distance and/or virtual; thus, it constitutes a process of adaptability, based on their prior knowledge, development of competencies, learning needs, or expectations, which often generates uncertainty requiring

support from the institution regarding academic, methodological, psychosocial, or technological aspects, establishing a link through pertinent and timely induction.

The literature review revealed that there have been studies related to the perceptions of autonomy, but very few of them referred to higher education with virtual methodology, rather they have focused on the role of the teacher in the process of development of student autonomy (Pérez & Yuste, 2023; Sun, *et al.*, 2022; Granero, *et al.*, 2021; Luelmo, 2020; Rizo, 2020), other studies have inquired about the use, relevance and convenience of learning strategies for the development of student autonomy in their learning (Caballero, *et al.*, 2023; Macazan, *et al.*, 2022; Canova & Pecker, 2019; Başbaği & Yilmaz, 2015). Regarding the relationships between perceptions of autonomy and academic performance, studies exploring both variables were found (Soza, 2021; Diaz, *et al.*, 2021; Carreño, *et al.*, 2020; Hussain, 2018).

Other studies, from the self-determination theory, have referred to the dynamics of relationships in the processes of autonomy and commitment to teaching and learning (Guay, 2022), to the need to experiment with new ways of teaching and learning to develop professional skills in students in virtual environments where knowledge is a dynamic and continuous construction (Hyeon, *et al.*, 2020), to the meaningful relationships between students' grades and the activities performed autonomously, and not those performed under the instruction of the teacher. Likewise, Lucas, *et al.* (2023) studied teacher behaviors and how they influence the development of student autonomy, and the latter as a predictor of success in academic achievement; the results show that teacher support positively predicts autonomy and academic performance and negatively predicts intentions to drop out of the system.

Abuhassna *et al.* (2020) estimated that learning styles contribute to the development of autonomous learning and directly to the

improvement of academic performance. Espinoza, *et al*. (2017), and Pacheco and Alatorre (2028) analyzed the strategies used by teachers in training in basic education, proving that there are no significant differences in the strategies used by students; however, difficulties persist for them to develop their autonomy. Lázaro and Solgorré (2023) approached from intellectual autonomy its relationships with learning styles and found that, if there are significant positive correlations, highlighting that the active and pragmatic styles are predictive. Başbaği and Yilmaz (2015), as well as Pérez and Yuste (2022), indicate that study habits and learning strategies, typical of basic secondary education remain in higher education and that the latter, demands autonomy in knowledge management; they also evidence that there is no awareness on the part of the student, of learning strategies applied to the training activities carried out in basic secondary education. And Giri and Paily (2020) affirm that autonomy can be promoted with practices and strategies that favor the development of argumentative capacity, reflection, decision making and responsibility, thus promoting the moral and intellectual development of students, their autonomy is favored, among other aspects.

Regarding academic performance, Carreño, *et al*. (2020), O'neill, *et al*. (2020), and McNeese, *et al*. (2017) found that factors such as gender, study and work, attitude and conformity with the career, and grades positively influence the development of autonomy, while socioeconomic factors are not influential. Oliva and Mella (2013) conducted a study on the perception of academic performance of dentistry students and determined, through variable analysis, that the perception of performance is a socio-educational construction linking multiple interacting variables resulting in a formal rating. For Otero, *et al*. (2021), Robin and Major (2020), and Huéscar, *et al*. (2020), one of the main challenges for universities is to achieve quality education, which is associated with students' academic success, determined by multiple factors, including academic performance; this imposes

a challenge in the processes of institutional accreditation in higher education, since educational projects must respond promptly to the changes and needs of society.

In Colombia, higher education's virtual program offerings are widely accepted, making it necessary to study best practices so that students entering these programs empower their learning according to their personal and professional interests (Ferrer, 2022; Alsharari *et al.*, 2021; Pelikan *et al.*, 2021). Colombian universities traditionally organize induction processes and sessions, which serve as spaces to extensively discuss aspects related to the administrative and academic structure of chosen programs (Ahumada, *et al.*, 2020; Echeverría & Mazzitelli, 2021). However, they are limited in reflecting on aspects related to student role performance, study strategies, methodologies, study tools, communication, interactions, knowledge construction, and evaluation system. It is therefore necessary to work from a teaching-learning model mediated by digital tools to promote student autonomy; this requires, among other things, adapting to new learning environments, study routines, increasing sources and diversity of consultations, carrying out self-regulation processes and adjustments to the constructs performed, among others. In this regard, strengthening academic autonomy requires an institutional commitment aimed at transforming pedagogical practices. It is clear that teachers must assume the role of learning mediators, seeking the development of self-regulation, critical thinking, and collaborative learning. Likewise, teaching strategies should create spaces for continuous reflection, self-evaluation, and peer evaluation (Castañeda Fuentes, *et al.*, 2025).

Given the previous premises, this paper presents the results of a case study whose purpose was to determine whether the variable perception of autonomy is related to the academic success of students in virtual education and whether the Autonomy Level Scale instrument is reliable for the estimation.

Method

Design and instrument

A descriptive, analytical, and correlational educational study with a quantitative approach was conducted. The objective was to determine the level of autonomy of university students enrolled in a virtual distance education program, establishing the reliability of the instrument used, called the Autonomy Level Scale (ENA), designed by Rosso (2018) based on the criteria established by Montero and León (2007) and Zeleman (2007; 2012), and adjusted for this study. The correlation between the 67 items of the scale was evaluated, and subsequently, the relationship between the average academic performance for the semester and the perception of autonomy was estimated.

The ENA instrument groups seven dimensions: D1. Decision-making and coping mechanisms, D2. Vocational orientation, motivation for career choice, D3. Professional orientation, self-planning, and identification of learning goals, D4. Academic commitment, control, and academic self-regulation, D5. Learning strategies, D6. Academic and social workgroups, and D7. Self-evaluation and use of information in personal development and other purposes.

The research team verified that the terminology and phrasing of the items were consistent with the institutional and cultural context of the participating universities. Minor wording adjustments were made to facilitate comprehension without altering the original meaning or structure of the instrument.

Population and sample

The population corresponds to students enrolled in academic periods 1604 and 2022-3 at the Higher Education Institutions (IES) Universidad

Nacional Abierta y a Distancia (UNAD) and Fundación Universitaria Católica del Norte (FUCN).

Inclusion criteria were (a) being an active student in undergraduate distance education programs during the study periods; (b) voluntarily agreeing to participate and disponibility; and (c) providing access to their academic performance records.

Exclusion criteria included (a) incomplete responses of the ENA items, (b) failure to provide valid academic performance data, or (c) withdrawal of informed consent during the process.

The final sample included 430 students who met these criteria, 165 from FUCN and 265 from UNAD, who completed the ENA survey and shared their academic performance data. All participants signed informed consent, in accordance with Law 1581 of 2012 for data protection in Colombia.

Data Analysis

Statistical analysis was performed using descriptive and inferential techniques. The correlations between students' average academic performance and their perception of autonomy were calculated, using the Spearman's Rho correlation coefficient. According to Martínez (2009), this coefficient is recommended for data with extreme values that affect Pearson's correlation coefficient or for non-normal distributions, and consistent with Mondragón (2014), Spearman's Rho allows the intensity of association between two quantitative variables to be examined.

The level of autonomy was estimated by summing the responses to the 67 proposed items, using the Rasch model to calculate the quartiles, which determined that participants located in quartile 2 (Q2) or higher were considered autonomous.

To verify the internal consistency and dimensional coherence of the proposed dimensions, a Confirmatory Factor Analysis (CFA) was conducted, which, according to Palacios and Suárez (2017) and Medrano and Muñoz-Navarro (2017), allows relationships between observed variables and latent variables to be established, providing a clear structure of the dimensions of autonomy. The analysis examined the significance of the factor loadings and their correspondence with the theoretical structure.

Finally, descriptive statistics and item-level p-values were analyzed to assess the strength of the relationships between autonomy and academic performance. These results provided analytical transparency and reinforced the interpretation that students with higher perceptions of autonomy tend to achieve better academic outcomes.

Results

Table 1 presents the average responses of the students from both universities and the Cronbach's alpha coefficients for each dimension of the instrument.Subsequently, an Infit and Outfit analysis to conducted to identify items that, within the questionnaire, required revision, either because they do not adequately measure values around the mean or extreme values, as detailed in tables 2 through 8.

Table 1. Average responses by dimension (UNAD and FUCN.

Dimension	Average	Alpha
Dimension 1	3.490930	0.9231945
Dimension 2	3.476412	0.8938738
Dimension 3	3.368439	0.8357256
Dimension 4	3.156977	0.8901950
Dimension 5	3.253156	0.8261564
Dimension 6	3.110388	0.9093246
Dimension 7	3.418393	0.9049072
Instrument	3.304825	0.9796693

The analysis of the Information-weighted Fit Statistic (Infit) and the Outlier-sensitive Fit Statistic (Outfit) allowed us to identify items that fit well within the expected model behavior and those that require revision. In the Rasch model, Infit values close to 1.0 indicate that the item responses behave consistently with the model's expectations. Values substantially lower than 1 suggest redundancy or predictability, while values greater than 1 indicate that the item responses are more erratic or inconsistent responses. Similarly, Outfit values close to 1 represent good fit, while Outfit values greater than 2 suggest that respondents with extreme scores (very high or very low autonomy) answered the item in an unexpected way, possibly due to ambiguous wording or contextual misinterpretation (Verdú-Soriano y Gonzalez-de-la-Torre, 2024).

To ensure the stability and reliability of the estimates, 40 simulations of the Rasch model were performed. Considering these simulations, Infit and Outfit values between 0.2 and 1.5 were regarded as acceptable, since they indicate a reasonable level of consistency between the observed data and the model's expectations.

Table 2. Fit value for Dimension 1.

Items	Infit	Outfit
The decisions I make about myself will give me a better quality of life.	0.4961653	0.3105478
It's my responsibility to build the life I desire.	0.5609971	2.0562263
It's my responsibility to build my own future.	0.4740068	0.4306907
The decisions I make lead me to be responsible for the outcomes.	0.6093087	0.5805632
I am the architect of my own life.	0.5324901	0.4860092
I strive every day to achieve a better future.	0.5427732	0.3868442
The living conditions I have are my responsibility.	0.6931437	8.3245108
I make decisions based on what I believe.	0.6451722	9.7308447
I need to transform my life.	0.9458200	14.0892365
I have a set timeframe to reach my goals.	0.7165723	5.7449040

The ten items of Dimension 1, corresponding to *decision-making and coping mechanisms in autonomy*, showed Infit values ranging from

0.4740068 and up to 0.945820, which fall within the acceptable range for the Rasch model and indicate that all items contribute meaningfully to estimating students' ability levels. These results, obtained after 40 model simulations using the fextable package, confirm a good internal consistency of this dimension, suggesting that respondents' answers generally aligned with the model's expectations.

The shaded items in Table 2, Outfit column, revealed several items with extreme values. These high Outfit values (>2) indicate atypical or unexpected response patterns, possibly due to ambiguity in item wording or differences in how students interpret the underlying concepts of responsibility and self-transformation. Such items should therefore be reviewed and potentially reworded to improve measurement precision at the extremes of the autonomy scale.

Table 3. Fit value for Dimension 2.

Items	Infit	Outfit
It's important for me to continue studying.	Inf	0.2364563
I decided to study the career I like.	0.6691346	0.5022186
Working in this profession will make me happy.	0.6113058	0.4922950
The career I study allows me to learn about the topics that interest me.	0.5330280	0.3341737
I find it easy to learn from all the subjects taught in this career.	0.8766601	2.0889794
It's important to be a good student in this career.	0.6054251	0.9159318
I strive in my studies to become a good professional.	0.5780616	0.3799747

The seven items comprising the *vocational orientation dimension, motivation for career choice* dimension generally demonstrated adequate fit within the Rasch model. However, two items require further review. The statement "It is important for me to continue studying" presented an infinite Infit value, suggesting that it failed to discriminate between participants with different autonomy levels, possibly due to the item being too easy or too difficult for the sample. Likewise, the item "I find it easy to learn from all the subjects taught in this career" showed an Outfit value of 2.0889794 indicating that

there are atypical response patterns and the item does not adequately discriminate respondents' answers.

These findings, obtained after 40 model simulations to ensure stability and reliability, suggest the need to rephrase both items to improve their clarity and their ability to capture meaningful variability among respondents.

Table 4. Fit value for Dimension 3.

Items	Infit	Outfit
Becoming a professional in this discipline is important to me.	0.5991522	0.3786942
I am interested in solving social problems in my profession.	0.6755568	0.9739093
With this degree, I will enter a company.	0.7842957	1.2890216
I am interested in researching topics related to this field.	0.5496604	0.4580448
I have thought about starting my own company with the knowledge I acquire in this degree.	0.8729976	5.2779853
I plan to dedicate my life to working in the profession I am studying.	0.6020153	0.5679181
With this profession, it is possible to create new job opportunities.	0.5697849	0.8399600

The seven items that comprise the dimension *career orientation, self-planning and identification of learning goals* generally exhibited satisfactory fit indices. However, the statement "I have thought about starting my own company with the knowledge I acquire in this degree" should be revised, because the high Outfit value of 5.2779853 indicates a substantial discrepancy between the observed and expected responses under the Rasch model. This suggests that the item may have been interpreted inconsistently or that its wording introduced ambiguity among participants.

Table 5. Fit value for Dimension 4.

Items	Infit	Outfit
I take advantage of classes to clarify doubts about the topics I have studied.	0.6230457	0.4759042
I attend all the classes on my schedule.	0.7784370	15.8771168
I enjoy discussing class topics with the instructors.	0.7774030	2.2932630
I prepare class topics in advance.	0.7131605	2.4309506
I ask questions and express opinions in class.	0.7117720	0.5467062

Items	Infit	Outfit
I attend all classes with assignments completed.	0.6583171	0.4930390
I have a daily routine to dedicate myself to studying.	0.8006411	1.3458457
The University is my most important commitment.	0.7570482	1.0159293
I attend various activities or events related to my profession.	Inf	3.6662313
I set goals for each subject to achieve my professional objectives.	0.6199661	0.4738741

The Infit and Outfit results were estimated based on 40 model simulations, for the 10 items compromising *the academic commitment and academic self-regulation* dimension, the statement "I attend various activities or events related to my profession" should be reconsidered, as its infinite Infit value indicates a lack of variability among responses, suggesting that the item does not effectively discriminate between different levels of the assessed ability.

Additionally, the items highlighted in the Outfit column exceed acceptable thresholds, indicating that responses from participants with extreme autonomy levels deviated from the model's expectations. These items should be reviewed to improve their precision and alignment with the construct being measured.

Table 6. Fit value for Dimension 5.

Items	Infit	Outfit
It is important to be resourceful to complete all university assignments.	0.5650364	0.5559647
I delve deeper into the topics covered in each class.	0.6219902	0.6033875
I consult sources of information outside the classroom to better understand the topics.	0.6029651	1.5134629
I enjoy taking the initiative to develop class activities.	0.6703277	1.1805615
I participate in extracurricular activities related to my education.	0.8278726	3.0557323
I participate in study groups with people knowledgeable about topics in my field.	0.7243695	1.0512505
I have a rest routine that allows me to fulfill my academic responsibilities.	0.7620227	1.3400744

In the *learning strategies* dimension, only the item highlighted in Outfit column requires revision, as its value exceeds the acceptable threshold (greater than 1), indicating that it does not adequately

discriminate responses at the extreme levels of the latent trait. Suggesting that the item may not align fully with the expected response behavior within the Rasch model.

Table 7. Fit value for Dimension 6.

Items	Infit	Outfit
It is important in university to know people to share with.	0.6755697	0.6125506
Having friends in university is important.	0.7033117	0.6287759
Friends in university are a support in my learning.	0.7181656	0.8995688
Learning with others is necessary for my academic and professional development.	0.7330738	3.4957045
I do group work with people who enjoy studying.	0.6875517	0.5807182
In my study group, each member is knowledgeable about all the topics to present.	0.7185604	0.7188439
Every person participating in my study group fulfills the commitments made.	0.7116535	0.6495447
Through group work, I learn from my peers.	0.6590481	0.7213510
I choose the people with whom I should do group work.	0.8499794	4.4181954
The best students are part of my study group.	0.7316623	0.7911139
My family respects the decisions I make about my life.	0.7148027	0.6555778
I promptly communicate my decisions to my family.	0.7286447	0.8943449
It is important for my family that I successfully complete my degree.	0.6703572	0.5742950
I have the support of my family to dedicate time to studying.	0.7331272	1.4403710
In my family, we support each other to achieve academic success.	0.7784425	0.9803498

In the *academic and social work groups* dimension, the items highlighted in the Outfit column show values exceeding the acceptable range, indicating that they do not adequately discriminate among respondents, particularly at the extreme levels of autonomy. These elevated values, suggesting that the affected items may contain ambiguous wording or context-dependent interpretations that influence response patterns. Therefore, these items should be reviewed to enhance the construct validity and measurement precision of this dimension.

Table 8. Fit value for Dimension 7.

Items	Infit	Outfit
I am clear about the subjects in which I do not perform well.	0.7272046	140.3112843
I dedicate more interest to subjects that I consider difficult.	0.7358055	0.9178429

Items	Infit	Outfit
Having good academic results depends on myself.	0.5218525	20.3296508
I strive every day to achieve excellent academic results.	0.5406792	0.3410396
To be an excellent professional, I must be an excellent student.	0.6890282	1.2519629
I am interested in knowing my academic results.	0.5189984	2.2747305
My academic results reflect my dedication and effort.	0.6343376	0.7331930
The results in each assessment allow me to know where I should dedicate more time.	0.5988080	0.7815900
I seek opportunities with professionals in the field to deepen my knowledge of the discipline.	0.7964614	3.4296564
I propose and evaluate strategies to achieve my learning.	0.6366518	0.4626604
If I do not achieve the expected results, I undertake an improvement plan.	0.9525603	7.2848427

Within the eleven items of the *self-assessment use of information* dimension, some items displayed elevated Outfit values, revealing inconsistencies in participants' response patterns. Although such deviations were confirmed across the 40 model simulations, they appear concentrated in items where the wording may introduce ambiguity or overlap between self-assessment and motivation constructs. Consequently, these items should be refined to enhance the conceptual clarity and internal consistency of this dimension.

Confirmatory Factor Analysis (CFA)

To complement the Rasch model results, a Confirmatory Factor Analysis (CFA) was conducted to examine whether the items grouped coherently according to the seven theoretical dimensions proposed in the ENA instrument. Table 9 summarizes the dimensions, their conceptual interpretation, and the definition of observed and latent variables.

The CFA results supported the dimensional structure of the instrument, indicating that items aligned with their respective latent variables. Nonetheless, a few items exhibited weaker factor loadings within their dimensions,consistent with the Rasch results that suggested potential revision.

Conceptual evaluation of convergent and discriminant validity revealed that each dimension correlated more strongly with its own items than with those of other dimensions. This pattern was observed across the data, providing preliminary evidence that the ENA measures distinct but related aspects of autonomy.

Table 9. Latent and observed variables of the ENA instrument and interpretation of its dimensions.

| Autonomy dimensions Latent variables	Items Observed variables	Interpretation and score contribution
Decision-making and coping mechanisms.	1 to 10 **D1** (D1.1 to D1.10)	The individual is the central subject of circumstances. Score: 40
Vocational orientation, motivation for career choice.	11 to 17 **D2** (D2.1 to D2.7)	The individual constructs their own reality. Score: 28
Professional orientation, self-planning, and identification of learning goals.	18 to 24 **D3** (D3.1 to D3.7)	The individual projects their future to avoid getting lost in the short term. Score: 28
Academic commitment, control, and academic self-regulation.	25 to 34 **D4** (D4.1 to D4.10)	The individual is responsible for circumstances. Score: 40
Learning strategies.	35 to 41 **D5** (D5.1 to D5.7)	The individual is responsible for their learning process. Score: 28
Academic and social work groups.	42 to 56 **D6** (D6.1 to D6.15)	The individual understands and questions social dynamics. Score: 60
Self-assessment of information use in their own education and other purposes.	57 to 67 **D7** (D7.1 to D7.11)	The individual self-governs and self-regulates. Score: 44
Total instrument score		**268**

Figure 1. Confirmatory Factor Analysis of the ENA Instrument.
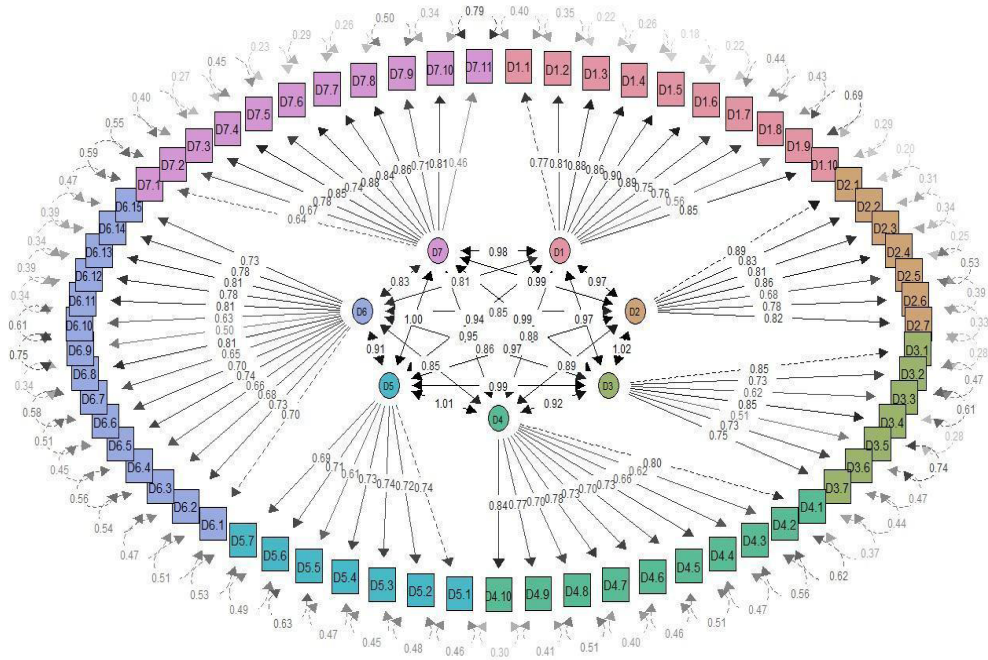
Figure 1 illustrates the relationships among the seven dimensions and their corresponding items. The central nodes represent the latent variables, the connecting lines display the correlations among them, and the peripheral indicators denote the observed items with their respective error calculations.

Next, Table 10 presents the items that showed statistically significant or near-significant correlations with students' semester average grades.

Table 10. Correlation of items with students' grades.

Items	P-value Significance
I make decisions based on what I think.	0.0213595120
I find it easy to learn from all the subjects taught in this major.	0.0510865329
It is important to be a good student in this major.	0.0235814206
I plan to dedicate my life to working in the profession I am studying.	0.0049534402
I attend all classes on schedule.	0.0794138316
I enjoy discussing class topics with teachers.	0.0313783338
I prepare class topics in advance.	0.0497347040
I ask questions and express opinions in class.	0.0149765943
I attend all classes with assignments up to date.	0.0584986248
I have a daily routine for studying.	0.0023963454
I participate in study groups with people who are knowledgeable about topics in my major.	0.0084852829
Friends at university are a support in my learning.	0.0092916992
Learning with others is necessary for my academic and professional development.	0.0109967597
I do group work with people who enjoy studying.	0.0096811143
The best students are part of my study group.	0.0170498528
My academic results reflect my dedication and effort.	0.0405968324

Thirteen items presented p-values below .05, indicating positive associations between perceived autonomy and academic performance. These findings suggest that while autonomy is not the sole determinant of academic achievement, it contributes meaningfully to students' performance outcomes.

To establish the autonomy of the 430 participating students in the study, the results in autonomy were correlated with the academic average. The instrument's maximum possible score was 268, while autonomy values obtained through the Rasch model ranged approximately from –5 to 5 logits. Each item was rated on a four-point Likert scale, consistent with the theoretical design of the instrument.

Academic performance was measured using the students' semester grade averages, reported on a 1-to-5 scale, corresponding to the academic periods 2022-3 and 1604 at FUCN and UNAD, respectively.

Descriptive statistics of both the autonomy scores and the academic averages are summarized in Table 11.

**Table 11.** Data to implement Rasch model and establish participants' autonomy.

Descriptors	Score per question	Semester average grade	Score	Standard deviation of the grade	Standard deviation of autonomy
Min	1.000	0.000	70.0		
1st. Qu	3.000	3.300	205.0		
Mediana	4.000	3.900	225.0	33.40208	1.614686
Media	3.558	3.729	221.4		
3rd Qu	4.000	4.500	242.8		
Max	4.000	5.000	268.0		

The results show that the mean autonomy score 221.4 and the average grade 3.73 indicate a moderate to high level of autonomy among participants. In general, students located in the upper quartiles of autonomy tended to obtain higher academic averages, reinforcing the positive relationship between self-regulation, decision-making, and academic performance.

Figure 2, presents the distribution of autonomy levels among participants from both universities. In the case of UNAD, the distribution shows a balanced pattern; this suggests that most students are concentrated in the medium to high range, reflecting a generally consistent level of self-directed learning within this institution.

In contrast, FUCN polarized distribution, the results indicate greater variability among students, with a notable proportion positioned in the lower autonomy levels, which may point to differences in institutional or programmatic support for autonomous learning.

**Figure 2.** Distribution of students' autonomy level by institution.
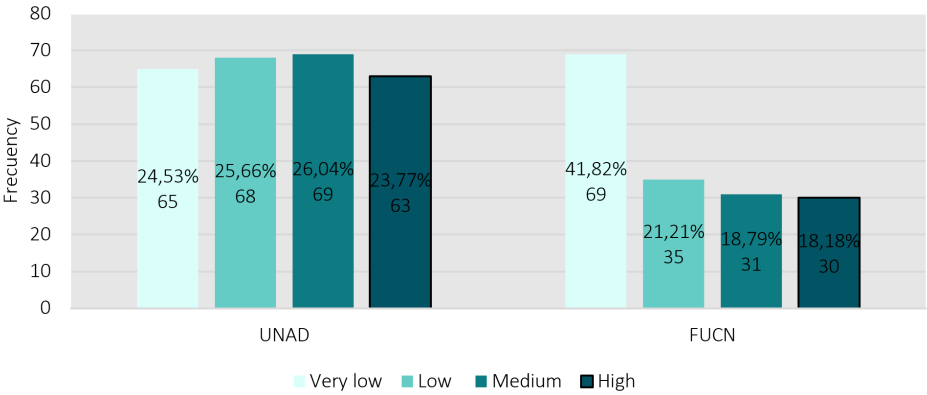
The distribution of autonomy of distance according to the academic level, as reported in Figure 3, shows higher frequencies in the levels of autonomy in undergraduate students for both universities compared to the level for graduate students.

Figure 3 illustrates the distribution of autonomy according to academic level. Among undergraduate students, the frequencies are showing a relatively balanced distribution with a slight predominance in medium and high autonomy levels. For graduate students, the frequencies indicate overall lower representation across all categories, consistent with the smaller sample size and potentially reflecting differing learning dynamics at advanced study levels.

Figure 3. Autonomy level of undergraduate and graduate students.
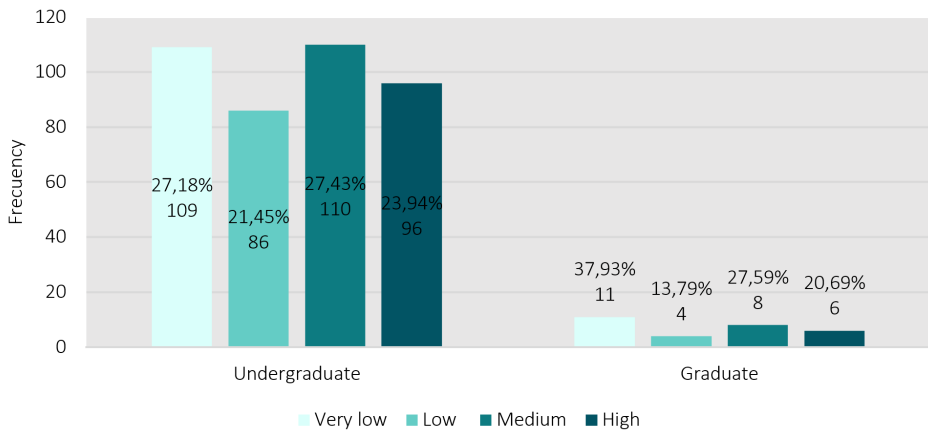
Finally, Figure 4 displays the autonomy distribution by gender in each institution. In both universities, women showed higher frequencies across the autonomy levels compared to men, suggesting a slightly stronger presence of self-regulated learning behaviors among female students in the virtual education context.

Figure 4. Autonomy level of students by gender.
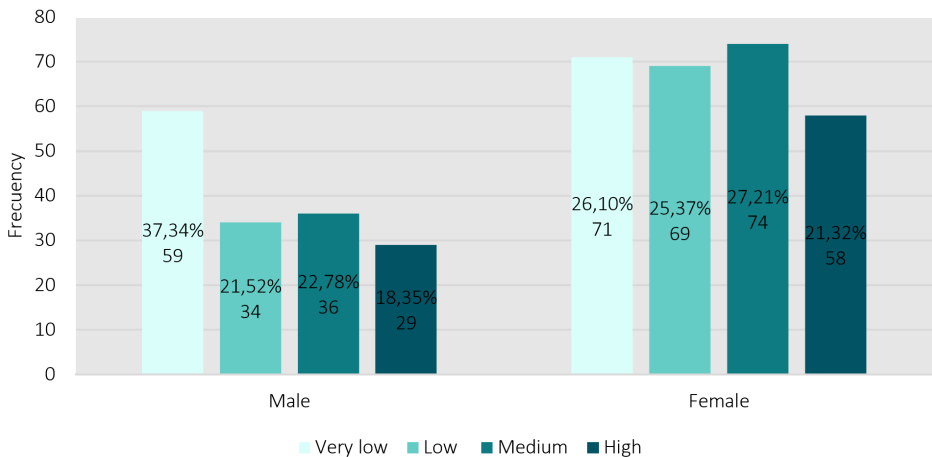
Discussions

The instrument Autonomy Level Scale (ENA), designed by Rosso-Londoño and Lozano-Ardila (2018), originally includes 65 items, with Likert-type response options ranging from 1 (strongly disagree) to 4 (strongly agree). For the purposes of this research, the instrument was adjusted by adding two items in dimension 7. The instrument's reliability was confirmed through Cronbach's Alpha (α) and the Rasch analyses, which is a stricter model than Alpha, as mentioned by Cerdas and Montero (2017), requiring the researcher to have a deep understanding of the construct being measured, demanding an explicit definition of processes and contents explaining the difficulty of the item.

Through the Rasch model, the Outfit and Infit statistics were used to identify items whose response patterns did not fully align with the model's expectations. Both are fit statistics and are used to identify outliers or inconsistencies in the participants' responses. The Infit statistic is particularly sensitive to discrepancies in responses that are close to the respondent's skill level. It mainly considers discrepancies in items whose difficulty is close to the individual's estimated ability, whereas the Outfit statistic that is more sensitive to extreme discrepancies; it considers both unexpected correct responses in difficult items and incorrect responses in easy items (Abdellatifa, 2023; Pérez-López *et al.*, 2021).

The calculation of Infit and Outfit by dimension was performed using 40 simulations to strengthen the robustness to the results. Based on these analyses, it is advisable to review the wording of the following items: 1.2, 1.7, 1.8, 1.9 and 1.10, 2.1, 2.5, 3. 5, 4.1, 4.2 and 4.3 ,5.3, 5.5 and 5.7, 6.4, 6.9, 7.1, 7.3, 7.9 and 7.11 to reduce ambiguities, according to the results, they are not capturing extreme values in the responses that are located in the extreme values, therefore,

they are susceptible to improvement. The above in coherence with Cupani & Cortez, 2016 and Aranzazu & Rodriguez (2022) who point out that values higher than 2 in Outfit or Infit is an indicator of adjustment. In particular, item 2.1 appears to require adjustment to better discriminate responses near the mean, while item 4.9 should be considered for replacement due to its inadequate alignment with the expected model behavior.

The CFA, supported the seven-dimensional structure, revealing strong relationship between the latent and observable variables defined in the instrument, consistent with what is expressed by Martínez (2021), the CFA confirms that the measures are consistent with the theory, the correlations by dimension are between .80 and 1, meaning they are considered in the range of good to excellent. As expected, lower correlation coefficients indicate greater measurement error within the corresponding dimension.

The items per dimension with the lowest correlation with the estimation of autonomy were: 1.9, 2.5, 3.3, 3.5, 4.2, 5.5, 6.9, 7.11. Among them, only item 7.11 showed a correlation below .50 (.46), suggesting that its wording should be revised to improve conceptual clarity. Regarding this, Morales and González (2013), cited by Martínez (2021), indicate that correlation values between .90 and 1 are excellent, those estimated between .80 and .90 are good, between 0.70 and 0.80 are acceptable; between .50 and .60 are low and less than .50 are unacceptable. In this case, only item 7.11, which corresponds to the assessment of the statement: "If I do not get the expected results, I undertake a plan for improvement," should be re-evaluated to ensure that it adequately represents the dimension it is intended to measure.

The p-values of the correlations calculated with the Spearman's rho statistic between the perception of autonomy and the average semester performance were significant for the following 16 items of the ENA instrument: 1.8, 2.5, 2.6, 3.6, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 5.6,

6.3, 6.4, 6.5, 6.10, and 7.7. There is statistical significance among the items of dimensions D1 to D7 listed, corresponding to significances lower than .05. According to Montes *et al.* (2021), Spearman correlations values between +.01 to +.10 correspond to weak positive correlations, values between +.11 to +.50 indicate moderate positive correlation, +.51 to +.75 represent a strong positive correlation, +.76 to +.90 indicate a very strong positive correlation, and +.91 to +1.00 correspond to a near perfect positive correlation. Since the p-values for these items were below the .05 threshold, the results confirm a statistically significant positive relationship between autonomy and academic performance. (Álvarez Orozco *et al.*, 2023)

On the other hand, the standard deviation of students' autonomy perception (1.61) was notably lower than that of academic performance (33.4), suggesting that students' perceptions of autonomy are more homogeneous than their academic results; in other words, the data deviate from the mean. Institutionally, 49.81% of UNAD students were categorized as autonomous, compared to 36.97% at FUCN suggesting differences possibly related to institutional or programmatic factors..

Finally, similar to other studies Barrientos *et al.* (2022); Ahumada *et al.*(2020) and Lasso (2020), the perception of autonomy among undergraduate students corresponded to 51.37%, while among graduate students, it reached 48.28%. Regarding gender, 48.53% of female participants and 41.14% of male participants were classified within the medium and high autonomy levels, suggesting a modest advantage for women in self-regulated learning behaviors. Overall, 44.88% of all participants were classified as autonomous.

The positive and statistically significant correlations between autonomy and academic performance highlight the central role of self-regulated learning in virtual higher education. Students with higher autonomy levels tend to achieve stronger academic outcomes, supporting theoretical perspectives that emphasize autonomy as a

key competency in online learning environments (Suárez Goméz *et al,* 2024).

These findings emphasize the need for higher education institutions to design and implement pedagogical strategies that promote self-directed learning, reflective practices, and metacognitive regulation. Strengthening autonomy is not only a matter of individual skill development but also of institutional commitment to flexible, student-centered pedagogical models, in line with what has been stated by (Morales Sánchez, 2024).

One limitation of this study lies in the restricted access to disaggregated academic performance data. Only overall semester averages were available, which prevented a more detailed analysis of how autonomy relates to specific disciplinary performance. Moreover, as the data were self-reported, the findings may reflect students' perceptions rather than direct behavioral evidence of autonomous learning. Future research should incorporate multiple data sources to triangulate results and provide a more comprehensive understanding of autonomy in practice.

Another limitation concerns the cross-sectional nature of the research design, which limits causal inference. Longitudinal studies would be valuable to observe how autonomy evolves over time and how specific pedagogical interventions affect its development in virtual learning contexts.

Given its demonstrated reliability and dimensional consistency, the instrument can be confidently used in future research on autonomy in virtual and distance education. Nonetheless, it is advisable that subsequent applications review and refine the items identified with low fit values to enhance discriminative capacity and semantic precision. Future research could also adapt the instrument for specific disciplinary

contexts or apply it longitudinally to analyze how autonomy evolves as students advance through their academic programs.

Conclusions

The relationship between autonomy of both undergraduate and graduate university students and their academic performance shows differences by gender, university institution and academic level. Autonomy has been evaluated with the ENA instrument and the validity of the instrument has been assessed with statistics such as Cronbach's Alpha reliability index, the Infit and Outfit analysis as part of the Rasch model for each of the dimensions that make up the survey, the Confirmatory Factor Analysis and the determination of the latent variables, demonstrate strong internal consistency and dimensional coherence in the assessment of student autonomy.

The ENA instrument is appropriate for assessing autonomy in that 99.25% of the items contribute meaningfully to the estimation of autonomy, the Cronbach's alpha result, which yielded a value of over 0.9, confirming high reliability.Likewise, Infit and Outfit statistics within the Rasch model indicated that the vast majority of items fit the model expectations, with only a few requiring refinement to improve discrimination at the extremes of the scale.

In terms of descriptive findings, 49.81% of UNAD students and 36.97% of FUCN students were classified as autonomous. In addition, 51.37% of undergraduate students and 48.28% of graduate students perceive themselves as autonomous. When analyzed by gender, 41.14% of males and 48.53% of females are located in medium and high levels of autonomy, reflecting differences in the perception of autonomy among different demographic groups.

The Spearman correlation analysis shows a statistically significant relationship between the perception of autonomy and the average

academic performance of the semester for 16 items of the ENA instrument. These items present p-values below .05, indicating that the perception of autonomy measured by these items is positively related to academic performance. This suggests that students with a higher perception of autonomy tend to achieve better academic outcomes. Among the seven dimensions of the instrument, the ones with the highest correlation with performance are dimension four, related to the student's individual commitment, and dimension six, which refers to academic and social work groups.

Although the standard deviation of the autonomy perception data (1.61) was considerably lower compared to the standard deviation of academic performance (33.4). This indicates that academic performance scores are much more dispersed and vary widely among students. Despite this variability, a significant relationship was found between the perception of autonomy and academic performance in multiple items, reinforcing the importance of autonomy in the educational context.

For higher education institutions, particularly those operating in virtual and distance learning environments, it remains a challenge to promote the use of strategies that foster the development of students' autonomous learning, given that the evidence demonstrates positive relationships between levels of autonomy and academic performance.

Acknowledgements

References

Abdellatifa, H. (2023). Test results with and without blueprinting: Psychometric analysis using the Rasch model. *Educación Médica, 100802.* https://doi.org/10.1016/j.edumed.2023.100802

Abuhassna, H., Al-Rahmi, W.M., & Yahya, N. (2020). Development of a new model on utilizing online learning platforms to improve students' academic achievements and satisfaction. *Int J Educ Technol High Educ, 17*(38). https://doi.org/10.1186/s41239-020-00216-z

Acosta, A. (2020). Autonomía universitaria y estatalidad. [University Autonomy and Statehood]. *Revista de la educación superior*, *49*(193), 1-23. https://doi.org/10.36857/resu.2020.193.1025

Afacan, A., & Gülbahar, Y. (2023). Learner autonomy in online learning: Development and validation of a scale. *Journal of Higher Education and Science/ Yükseköğretim ve Bilim Dergisi, 13*(1), 116-125. https://doi.org/10.5961/higheredusci.1152249

Ahumada, V., Gutiérrez, D., Londoño, E. P., & Guerrero, J. H. (2020). La satisfacción en el proceso formativo en escenarios digitales: inducción acompañamiento y autonomía. [Satisfaction in the educational process in digital scenarios: induction, support, and autonomy]. Sello Editorial UNAD. https://doi.org/10.22490/9789586517430

Ahumada, V., Gamboa, M. C., Gutiérrez, M. D., Londoño, E. & Hernández, F. (2024). El éxito académico universitario desde la percepción de autonomía de los estudiantes. [Academic success at university from the perspective of student autonomy]. Sello Editorial UNAD. https://doi.org/10.22490/9789586519618

Alsharari, N.M., & Alshurideh, M.T. (2021). Student retention in higher education: the role of creativity, emotional intelligence and learner autonomy. *International Journal of Educational Management, 35* (1), 233-247. https://doi.org/10.1108/IJEM-12-2019-0421

Álvarez Orozco D. G., Ruiz Domínguez V. E., ., & Ramírez Manjarrez N. I. (2023). Codependencia laboral: análisis factorial confirmatorio. [Workplace codependency: confirmatory factor analysis].*Investigación y desarrollo, 30*(2), 67-190. https://doi.org0./10.14482/indes.30.2.158.7

Aranzazu-Moya G.C., & Rodríguez M.J. (2022). Validez y confiabilidad de un cuestionario sobre satisfacción en usuarios de prótesis dentales totales. [Validity and reliability of a questionnaire on satisfaction in users of complete dentures]. *Revista Ciencias Salud. 20*(2), 1-15. https://doi.org/10.12804/revistas.urosario.edu.co/revsalud/a.10795

Barrientos, P., Pérez, M.V., Vergara, J., & Díaz, A. (2021). Influencia de la percepción de apoyo a la autonomía, la autoeficacia y la satisfacción académica en la intención de permanencia del estudiantado universitario. [Influence of the Perceived Autonomy Support, Self-Efficacy, and Academic Satisfaction in the Intentions of Permanence of University Students]. *Revista Electrónica Educare*, *25*(2), 90-103. https://dx.doi.org/10.15359/ree.25-2.5

Başbaği, L., & Yilmaz, O. (2015). Autonomous foreing language learning. *Journal of Languages and Culture, 6*(8), 71-79. https://doi.org/10.5897/JLC2015.0338

Caballero, J., Chávez, E., López, M., Inciso, E., & Méndez, J. (2023). Autonomous learning in higher education. Systematic review. *Salud, Ciencia Y Tecnología*, *3*, 391. https://doi.org/10.56294/saludcyt2023391

Canova, C. J., & Pecker, L. F. (2019). Características del aprendizaje autónomo en estudiantes de Kinesiología de una Institución de Educación Superior de Buenos Aires. [Characteristics of autonomous learning in kinesiology students at a higher education institution in Buenos Aires]. *Investigación En Enfermería: Imagen Y Desarrollo*, *21*(2). https://doi.org/10.11144/Javeriana.ie21-2.caae

Cárcel, F. (2016). Desarrollo de habilidades mediante el Aprendizaje Autónomo. [Development of skills through autonomous learning]. *3C Empres, Valencia España, 5*(3), 52- 60. http://dx.doi.org/10.17993/3cemp.2016.050327.63-85

Carreño, K., De la Cruz, W., García, K., & Latorre, A. (2020). Factores influyentes en el rendimiento académico de los estudiantes en las instituciones de educación superior. [Influential factors in academic performance of students in higher education institutions]. *Investigación y Desarrollo en TIC, 11*(1). 57-69. https://hdl.handle.net/20.500.12442/6975

Castañeda Fuentes J.G., Pinto Ayala B. E., & Sojos Tubay A. M., (2025). Fomentando el Pensamiento Crítico mediante Aprendizaje Colaborativo y Cooperativo: Estrategias para Mejorar la Enseñanza. [Promoting Critical Thinking through Collaborative and Cooperative Learning: Strategies for Improving Teaching]. Revista Scientific, 9(31), 126-143. https://doi.org/10.29394/scientific.issn.2542-2987.2024.9.31.6.126-143.

Cerdas, D., & Montero, E. (2017). Uso del modelo de Rasch para la construcción de tablas de especificaciones: Propuesta metodológica aplicada a una prueba de selección universitaria. [Use of the Rasch Model for the construction of specifications cables: Methodological proposal applied to a university selection test]. *Actualidades Investigativas En Educación, 17*(1). https://doi.org/10.15517/aie.v17i1.27299

Cruz, W., Nascimento, M., & Viana, M. (2019). O olhar do professor universitário sobre a autonomia do aluno em ambientes de tecnologias de aprendizagem. [A university professor's perspective on student autonomy in learning technology environments]. *Revista e-Curriculum, 17*(4), 1855-1884. https://doi.org/10.23925/http://dx.doi.org/10.23925/1809-3876.2019v17i4p1855-1884

Cupani, M., & Cortez, F. D. (2016). Análisis psicométricos del Subtest de Razonamiento Numérico utilizando el Modelo de Rasch. [Psychometric Analysis of Numerical Reasoning Subtest Using the Rasch Model]. *Revista de psicología (Santiago), 25*(2), 01-16. http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0719-0581201600020000200002&lng=es&tlng=es

Deroncele, A., Gross, R., & Medina, P. (2021). La autonomía pedagógica como potencialidad formativa en los actores educativos del aula. [Pedagogical autonomy as a training potential in educational actors in the classroom]. *Conrado*, *17*(79), 225-233. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1990-86442021000200225&lng=es&tlng=es

Díaz, M., Hervás, C., De La Calle, A., & López, E. (2022). Autonomy, Motivation, and Digital Pedagogy Are Key Factors in the Perceptions of Spanish Higher-Education Students toward Online Learning during the COVID-19 Pandemic. *Int J Environ Res Public Health, 19*(2), 654. https://doi.org/10.3390/ijerph19020654

Díaz, B., Meleán, R., & Marín, W. (2021). Rendimiento académico de estudiantes en educación superior: predicciones de factores influyentes a partir de árboles de decisión. [Academic performance of students in higher education: predictions of influential factors from decision trees]. *Telos: revista de Estudios Interdisciplinarios en Ciencias Sociales, 23* (3), 616-639. https://ojs.urbe.edu/index.php/telos/article/view/3568

Echeverría, J., & Mazzitelli, C. (2021). Estudio de la percepción sobre los factores institucionales que influyen en el rendimiento académico de estudiantes de la Universidad Estatal a Distancia de Costa Rica. [Study of the perception of institutional factors that influence the academic performance of students at the State Distance University of Costa Rica]. *Revista Electrónica Educare*, *25*(2), 1-20. https://doi.org/10.15359/ree.25-2.18

Espinoza, E., Serrano, O., & Brito, P. (2017). El trabajo autónomo en estudiantes de la Universidad Técnica de Machala. [Autonomous work in students of the Technical University of Machala]. *Revista Universidad y Sociedad*, *9*(2), 202-212. https://rus.ucf.edu.cu/index.php/rus/article/view/569

Ferrer, J., Ringer, A., Saville, K., Parris, K., & Kashi, K. (2022). Students' motivation and engagement in higher education: the importance of attitude to online learning. *High Educ, 83*, 317–338. https://doi.org/10.1007/s10734-020-00657-5

Giri, V., & Paily, M.U. (2020). Effect of Scientific Argumentation on the Development of Critical Thinking. *Sci & Educ, 29,* 673–690. https://doi.org/10.1007/s11191-020-00120-y

Granero, A., Hortigüela, D., Hernando, A., & Carrasco, M. (2021). Estilo docente y competencia en Educación Superior: mediación del clima motivacional. [Teaching style and competence in Higher Education: mediation of the motivational climate]. *Educación XX1, 24*(2), 43-64. https://doi.org/10.5944/educXX1.28172

Guay, F. (2022). Applying Self-Determination Theory to Education: Regulations Types, Psychological Needs, and Autonomy Supporting Behaviors. *Canadian Journal of School Psychology*, *37*(1), 75-92. https://doi.org/10.1177/08295735211055355

Huéscar, E., Moreno, J., Cid, L., Monteiro, D., & Rodrigues, F. (2020). Passion or Perseverance? The Effect of Perceived Autonomy Support and Grit on Academic Performance in College Students. *International Journal of Environmental Research and Public Health 17*(6), 1-13. https://doi.org/10.3390/ijerph17062143

Hussain, S., Neama, D., Fadl, B., & Najoua, R. (2018). Educational Data Mining and Analysis of Students Academic Performance Using WEKA. *Indonesian Journal of Electrical Engineering and Computer Science, 9*(2), 447-459. http://doi.org/10.11591/ijeecs.v9.i2.pp447-459

Hyeon, S., Reeve, R., & Vansteenkiste, M. (2020). When teachers learn how to provide classroom structure in an autonomy-supportive way: Benefits to teachers and their students. *Teaching and Teacher Education, 90.* https://doi.org/10.1016/j.tate.2019.103004.

Lasso, L. (2020). Análisis de la formación posgradual a nivel de maestría y doctorado en Colombia entre 2010 y 2018. [Analysis of postgraduate training at the master's and doctoral level in Colombia between 2010 and 2018]. *Espacios 41*(48), 161-176. http://dx.doi.org/10.48082/espacios-a20v41n48p12

Lázaro, I., & Solgorré, O. (2023). Influencia de los estilos de aprendizaje en la autonomía intelectual (Tesis de licenciatura, Universidad de Ciencias y Humanidades). [Influence of learning styles on intellectual autonomy (Bachelor's thesis, University of Sciences and Humanities)]. http://hdl.handle.net/20.500.12872/776

López., Y., Cobo, C, Pérez, M. & Díaz, A. (2021). Apoyo social, autonomía, compromiso académico e intención de abandono en estudiantes universitarios de primer año. Social support, autonomy, academic commitment and intention to drop out in first-year university students]. *Formación universitaria*, *14*(3), 139-148. https://dx.doi.org/10.4067/S0718-50062021000300139

Lucas, M. & Vicente, P.N. (2023). A double-edged sword: Teachers' perceptions of the benefits and challenges of online teaching and learning in higher education. *Educ Inf Technol 28*, 5083–5103. https://doi.org/10.1007/s10639-022-11363-3

Luelmo, M.J. (2020). Autonomía del alumno: implicaciones para el profesor. [Student autonomy: implications for the teacher]. *ENSAYOS, Revista de la Facultad de Educación de Albacete, 35*(2). http://www.revista.uclm.es/index.php/ensayos

Macazana, D. M., Rodríguez, C., Collazos, E., Pastor, J., & Castañeda, R. H. (2022). Evaluación auténtica y autonomía estudiantil. [Authentic assessment and student autonomy]. *Universidad & Sociedad*, *14*(S2), 185-193. https://rus.ucf.edu.cu/index.php/rus/article/view/2780

Marín, D., Gabarda, V. & Ramón, J.A. (2022). Análisis de la competencia digital en el futuro profesorado a través de un diseño mixto. [Analysis of digital competence in future teachers through a mixed design]. *Revista de educación a distancia, 22*(70). http://dx.doi.org/10.6018/red.523071

Martínez, M. (2021). Análisis factorial confirmatorio: un modelo de gestión del conocimiento en la universidad pública. [Confirmatory factor analysis: a model of knowledge management in the public university]. *RIDE. Revista Iberoamericana para la Investigación y el Desarrollo Educativo, 12*(23), e059. https://doi.org/10.23913/ride.v12i23.1103

Martínez, A. (2009). Seminario de tesis. Metodología de la investigación lingüística: El enfoque etnopragmático. [Thesis seminar. Linguistic research methodology: The ethnopragmatic approach]. En E. Narvaja de Arnoux (Dir.), *Writing and knowledge production in graduate studies.* Buenos Aires: Santiago Arcos.

McNeese, N. J., Demir, M., Cooke, N. J., & Myers, C. (2018). Teaming With a Synthetic Teammate: Insights into Human-Autonomy Teaming. *Human Factors*, *60*(2), 262-273. https://doi.org/10.1177/0018720817743223

Medrano, L. & Muñoz-Navarro, R. (2017). Aproximación conceptual y práctica a los Modelos de Ecuaciones Estructurales. [Conceptual and practical approach to Structural Equation Models]. *Revista Digital de Investigación en Docencia Universitaria, 11*(1), 219-239. https://dx.doi.org/10.19083/ridu.11.486

Mondragón, M. (2014). Uso de la correlación de Spearman en un estudio de intervención en fisioterapia. [Use of Spearman's correlation in a physical therapy intervention study]. *Movimiento científico, 8* (1), 98-104. https://doi.org/10.33881/2011-7191.mct.08111

Montero, I., & León, O. (2007). A guide for naming research studies in Psychology. *International Journal of Clinical and Health Psychology, 7*(3), 847-862. https://www.redalyc.org/pdf/337/33770318.pdf

Montes, A., Ochoa, J., Juárez, B., Vázquez, M., & Díaz, C. (2021). *Aplicación del coeficiente de correlación de Spearman en un estudio de fisioterapia*. [Application of Spearman's correlation coefficient in a physical therapy study]. Cuerpo Académico de probabilidad y estadística. (BUAP). https://www.fcfm.buap.mx/SIEP/2021/CARTELES/Cartel%20Juliana.pdf

Morales Sánchez, O. (2024). Propuesta didáctica-pedagógica para fomentar la autonomía del aprendizaje en los centros de autoacceso de idiomas en modalidad virtual.[Didactic-pedagogical proposal to promote autonomous learning in virtual self-access language centers]. *RIDE Revista Iberoamericana Para La Investigación Y El Desarrollo Educativo, 15*(29). https://doi.org/10.23913/ride.v15i29.2063

Muhammad, M. (2020). Promoting Students Autonomy through Online Learning Media in EFL Class. *International Journal of Higher*, *9*(4), 320-331.https://doi.org/10.5430/ijhe.v9n4p320

Oliva, P., & Mella, C. (2013). Percepción de rendimiento académico en estudiantes de Odontología. [Perception of academic performance in dental students]. *Revista Cubana de Educación Médica Superior,* 27(1), 86-91. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21412013000100011&lng=es

O'Neill, T., McNeese, N., Barron, A., & Schelble, B. (2022). Human–Autonomy Teaming: A Review and Analysis of the Empirical Literature. *Human Factors*, *64*(5), 904-938. https://doi.org/10.1177/0018720820960865

Otero, M. J., Lorenzo, M., Otero, A., & Rego, M. A. (2021). Students' Mediator Variables in the Relationship between Family Involvement and Academic Performance: Effects of the Styles of Involvement. Psicología Educativa. *Revista de los Psicólogos de la Educación, 27*(1), 85-92. https://doi.org/10.5093/psed2020a19

Oveshkova, A.N. (2018). Work with English corpora as a means of promoting learner autonomy. *The Education and science journal, 20*(8). 66-87. (In Russ.). https://doi.org/10.17853/1994-5639-2018-8-66-87

Pacheco, A. M., & Alatorre, E. P. (2018). La metacognición en la profesionalización docente: el pensamiento crítico en un entorno mixto. [Metacognition in teaching professionalization: critical thinking in a mixed environment]. *Revista de Educación a Distancia (RED)*, *18*(56). https://revistas.um.es/red/article/view/321651

Palacios, M., & Suárez, E. (2017). Análisis Confirmatorio del Modelo Contable y la Gestión Ambiental en la Industria Hotelera de Panamá. [Confirmatory Analysis of the Accounting Model and Environmental Management in the Hotel Industry of Panama]. *Investigación administrativa, 46*(119). https://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2448-76782017000100001

Pelikan, E.R., Korlat, S., Reiter, J., Holzer, J., Mayerhofer, M., & Schober B. (2021) Distance learning in higher education during COVID-19: The role of basic psychological needs and intrinsic motivation for persistence and procrastination–a multi-country study. *PLoS ONE 16*(10). https://doi.org/10.1371/journal.pone.0257346

Peña, C., & Cosi, E. (2018). Relación entre las habilidades de Pensamiento Crítico y Creativo y el Aprendizaje autónomo en estudiantes de la Facultad de Ciencias Matemáticas. [Relationship between Critical and Creative Thinking skills and Autonomous Learning in students of the Faculty of Mathematical Sciences]. *Pesquimat*, *20*(2), 37-40. https://doi.org/10.15381/pes.v20i2.13965

Pérez-López, C., López-Franco M.D., Comino-Sanz I.M., & Pancorbo-Hidalgo, P.L. (2021). Validación del cuestionario de Conocimientos sobre prevención de lesiones por presión en estudiantes de enfermería: análisis Rasch. [Validation of the Pressure Injury Prevention Knowledge questionnaire in nursing students: Rasch analysis]. *Enfermería Clínica, 31*, 12-20. https://doi.org/10.1016/j.enfcli.2020.07.001

Pérez, E., & Yuste, R. (2023). La competencia digital del profesorado universitario durante la transición a la enseñanza remota de emergencia. RED. [The digital competence of university teachers during the transition to emergency remote teaching]. *Revista de Educación a Distancia, 23*(72). http://dx.doi.org/10.6018/red.540121

Prieto, G., & Delgado, A.R. (2003) Análisis de un test mediante el modelo de Rasch. [Analysis of a test by the Rasch model]. *Psicothema, 15*(1), 94-100. https://www.psicothema.com/pdf/1029.pdf

Ramón, A. (2019). Reconstruções da autonomia pessoal [Reconstructions of personal autonomy]. En Alterman Blay, E., Mercês de Avelar, L. y Duarte Rangel, P. (comps.) Gênero e feminismos: Argentina, Brasil e Chile em transformação. San Pablo, Editora Da Universidade de São Paulo (Edusp).

Rizo, M. (2020). Rol del docente y estudiante en la educación virtual. [Role of the teacher and student in virtual education]. *Revista Multi-Ensayos*, *6*(12), 28–37. https://doi.org/10.5377/multiensayos.v6i12.10117

Robin, M.A., & Major, J. (2020) What motivates higher education educators to innovate? Exploring competence, autonomy, and relatedness – and connections with wellbeing. *Educational Research, 62*(2), 146-161. https://doi.org/10.1080/00131881.2020.1755877

Rosso-Londoño, G.I., & Lozano-Ardila, M.C. (2018). Nivel de autonomía en estudiantes de primer semestre de tres universidades privadas de Bogotá. [Level of autonomy in first semester students of three private universities in Bogotá]. [Tesis de maestría, Universidad Católica de Colombia]. https://hdl.handle.net/10983/17616

Rué, J. (2009). *El aprendizaje autónomo en la Educación Superior*. [Autonomous learning in Higher Education]. Madrid: Narcea.

Soza, S. E. (2021). Factores asociados a la calidad del rendimiento académico de estudiantes en la educación superior. [Factors associated with the quality of academic performance of students in higher education]. *Revista Ciencias De La Salud y Educación Médica*, *3*(3). https://revistacienciasmedicas.unan.edu.ni/index.php/rcsem/article/view/79

Suárez Gómez, J., Muñoz Páliz, E., Baque Catuto, A., Suárez, G., y Tomalá, J. (2024). Incidencia de la autonomía en el rendimiento académico de un estudiante con retraso mental leve: una propuesta teórica. [Incidence of autonomy on the academic performance of a student with mild mental retardation: a theoretical proposal]. *LATAM Revista Latinoamericana De Ciencias Sociales Y Humanidades*, *5*(3), 2673 – 2684. https://doi.org/10.56712/latam.v5i3.2224

Sun, H., Sun, T., Sha, F., Gu, X., Hou, X., Zhu, F., & Fang, P. (2022) The Influence of Teacher–Student Interaction on the Effects of Online Learning: Based on a Serial Mediating Model. *Front. Psychol*. 13:779217. https://doi.org/10.3389/fpsyg.2022.779217

Viana, M., Alves, M., & Santos, L. (2015). Práticas Integradoras e Inclusivas no Ambiente Virtual de Ensino e Aprendizagem. [Integrative and Inclusive Practices in the Virtual Learning and Learning Environment]. IV Seminário WEB Currículo, 1000 – 1007.

Vygotsky, L. S. (1978). Mind in society: The development of higher mental processes. Cambridge, MA: Harvard University Press.

Verdú-Soriano, J y González-de la Torre. (2024). Aplicación del análisis Rasch en la investigación en enfermería: una introducción metodológica.[Application of Rasch analysis in nursing research: a methodological introduction]. *Enfermería Clínica, 34*(6), 493-506. https://doi.org/10.1016/j.enfcli.2024.10.005

Zemelman, H. (2012, 17 de mayo). Historia y autonomía. [History and autonomy]. *VIII Encuentro Nacional y Regional de Investigación Educativa.* México. [Video]. YouTube. https://www.youtube.com/watch?v=tIrKmPZC5j4

Zemelman, H. (2007). *El ángel de la historia: determinación y autonomía de la condición humana.* [The angel of history: determination and autonomy of the human condition]. Anthropos Editorial.

Zhong, Q. M. (2018). The evolution of learner autonomy in online environments: A case study in a New Zealand context. *Studies in Self-Access Learning Journal, 9*(1), 71-85. https://doi.org/10.37237/090106

Zimmerman, B. (2001), Theories of Self- An overview and analysis en Barry Zimmerman y Dale Schunk (eds.), Self-Regulated Learning and Academic Achievement: Theoretical perspectives, New Jersey, Lawrence Erlbaum Publishers, pp. 1-37.