

Article

Psychometric Analysis of the WoEm-M Scale to Evaluate Women Empowerment in the Ecuadorian University Environment

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Abstract: Women's empowerment embodies being acknowledged as rights-bearing individuals. Despite progress in women's rights, disparities persist across various domains. This study seeks to validate a psychometric scale of 31 items across seven factors: participatory empowerment, temerity, external influences, independence, social satisfaction, confidence, and equality. The aim is to assess women's empowerment within the university setting. The research was conducted in a cross-sectional, non-experimental manner, with the voluntary participation of 1478 university students from four higher education institutions in Zone 4 of Ecuador. Data was analyzed using inferential statistics, encompassing exploratory and confirmatory factor analysis. The results indicated that the empowerment measurement tool could consist of 24 items grouped into six factors, and this model exhibited a good fit. The validation process enabled us to pinpoint the principal factor explaining women's empowerment in higher education.



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1. Introduction

Women's empowerment involves acknowledging their status as individuals with full rights, capable of making decisions that impact their lives. As highlighted in Zimmerman [1], empowerment is a process that encompasses both individual and collective aspects, where women take charge and set objectives in response to their needs and challenges. Initially conceived as a political commitment [2], female empowerment has evolved to become one of the Sustainable Development Goals (SDGs) [3]. Countries have undertaken the responsibility of implementing public policies that promote this empowerment, and in this context, research plays a fundamental role in illuminating the reality that prevails in developing nations such as Ecuador. These investigations are crucial for evaluating progress towards commitments made at the United Nations Assemblies in Agenda 2030.

Empowerment processes must not be mere declarations; putting them into practical action is imperative. This entails comprehending the realities that women encounter and assessing levels of empowerment, both individually and collectively, across various settings, be it within the household, community, or broader national structures. It is crucial to gauge and comprehend factors such as resource access, capacity for action (agency), and accomplishments [2,4].

As underscored by the United Nations report on the Sustainable Development Goals (SDGs) [3], gender inequalities persist [5]; this is evident in the underrepresentation of women in leadership roles and the unequal distribution of domestic responsibilities, which remains three times higher for women than for men.

Empowerment encompasses various approaches, ideologies, movements, interpretations, strategies, and interest groups [6,7]. Moreover, it is closely tied to interdependence [8,9]. As women recognize their potential and value themselves, they come together in collectives with other women who share common goals that impact their lives. It is also defined as enhancing people's ability to make strategic decisions about their lives in a context where this power was previously denied [10]. This process is initiated at the individual level, as women can question and reflect on their existence [11]. Formal and non-formal education, along with cognitive processes of discussion and analysis, nurture the changes in this process; thus, training plays a pivotal role.

Education and continuous training are pivotal in tackling and mitigating gender inequalities. These resources play a crucial role in empowering women in leadership and decision making, with relevance in both private and public spheres [12,13]. Across history, women have ardently struggled for autonomy. For instance, a salary has granted them the agency to determine how to manage their finances, bolstering their financial independence. Nevertheless, this progress has also increased workload, as household chores and caregiving responsibilities predominantly remain with women [14].

Several authors concur that empowerment is fundamentally tied to women's autonomy, which is the foundation for making decisions concerning their lives, bodies, emotional well-being, economic independence, and social relations [15]. Empowerment is in line with socio-economic development, providing women with access to the same employment and educational opportunities as men [16].

Empowerment is inherently tied to participation as a fundamental right that ensures women can engage in diverse public and private spheres. It is crucial to emphasize that, as an individual process, it entails women acknowledging themselves as rights bearers, capable of making decisions, actively engaging in society, accessing services, and having resources [11].

A pertinent study in Africa suggests that matrilineality is linked to the empowerment of women and the narrowing of gender disparities. This study illustrates that access to resources and education positively impacts women's increased involvement in civic and political life [17].

Concerning university policies that promote women's involvement in the scientific arena, a study conducted in Italy presents noteworthy findings. This study illustrates that institutional policies have a beneficial effect on women's engagement in academia and research. Robinson and Gottlieb [17] suggest that these policies alleviate the disparities and barriers frequently hindering women's participation in these domains. Additionally, other studies have scrutinized women's involvement in political spheres and have determined that, to attain such participation, numerous women have had to negotiate with their families [18–20].

Empowerment is intimately tied to leadership as it posits that various points of synergy are transformed into shared objectives and goals by dismantling individual beliefs. Hence, transformational leadership is significant as a means to achieve empowerment [21]. A gender-focused study at a university in Saudi Arabia delved into transformational leadership and psychological empowerment among university leaders and subordinates, revealing that there are no gender-based disparities and that female leaders wield just as much influence as their male counterparts [22]. Nevertheless, barriers to leadership persist, including lack of support, discrimination, wage disparities, and workplace harassment [23]; this is epitomized by the "queen bee" syndrome [24,25], where women leaders perpetuate discriminatory notions among their female peers to hinder them from attaining similar positions. Moreover, they seek validation from others, rendering them more susceptible to criticism [26], placing them at a disadvantage compared to the opposite gender.

A study of women's empowerment in Spain discovered that this is attained through education, leading to more balanced decision making regarding consumption and financial management [27]. Moreover, robust evidence indicates that advocating for gender equality can alleviate household poverty, and resources under the control of women often yield

positive outcomes within the household [11,28]. Additionally, assessing empowerment entails examining aspects of individual character and interpersonal relationships.

Reviewing the literature on 12 instruments for measuring empowerment enabled us to pinpoint scales featuring distinct factors. (Table 1). For instance, a study validated a scale to assess the facets of empowerment in pregnant women in Iran. This scale comprises 38 items categorized under three dimensions: educational empowerment, autonomy, and socio-political empowerment. It exhibited high reliability, as indicated by a Cronbach's alpha coefficient of 0.92 [29].

Table 1. Instruments for measuring women's empowerment during the period 2008–2022.

N°	Name of the Instrument	Authors	Year	Country	Sample	Study Dimensions	Internal Consistency
1	Protocol for development and validation of instruments to measure women's empowerment in urban sanitation across countries in South Asia and Sub-Saharan Africa: The Agency, Resources and Institutional Structures for Sanitation-related Empowerment (ARISE)	Sinharoy et al. [30]	2022	India and Uganda	1000 women	Agency, leadership, freedom of movement, bodily integrity, safety and security, critical consciousness; Time, knowledge, and skills; Norms	Omega coefficient 0.70
2	Empowering Saudi women in higher educational institutions: Development and validation of a novel women empowerment scale	Al-Qahtani et al. [31]	2021	Saudi Arabia	160 female employees (teachers and administrative staff) in higher education institutions	Social/relational empowerment environmental/workplace, empowerment, self-esteem and self-efficacy, self-esteem and freedom of mobility, self-efficacy and freedom of mobility, self-efficacy and access to services, economic empowerment and access to resources, gender-based violence and access to resources	Cronbach's Alpha 0.94
3	Measuring the invisible: Development and multi-industry validation of the Gender Bias Scale for Women Leaders	Diehl et al. [32]	2020	United States	1079 university women	Male privilege, disproportionate constraints, insufficient support, devaluation, hostility, acquiescence	Cronbach's Alpha 0.80
4	Psychometric development and validation of attitude rating scale towards women empowerment: across male and female university population in Pakistan	Shuja et al. [33]	2020	Pakistan	500 university students: Male 180, Female 320	Personal freedom, equal rights, women's empowerment, related fears	Cronbach's Alpha 0.80
5	Psychometric properties of the short version of the Empowerment and Personal Agency Scale in university students.	Padilla et al. [34]	2020	Mexico	614 university students.	Personal agency, self-awareness, health empowerment, and social empowerment.	Cronbach's Alpha 0.81
6	The Reproductive Agency Scale (RAS-17): Development and validation in a cross-sectional study of pregnant Qatari and non-Qatari Arab Women	Yount et al. [35]	2020	Qatar	684 women	Intrinsic reproductive agency Instrumental reproductive agency Instrumental reproductive agency	Cronbach's Alpha 0.84
7	Validation of an instrument to evaluate attitudes towards Gender Equality in University students	Castillo Quintero et al. [36]	2020	Ecuador	290 students	Socio-cultural, relational, and personal	Cronbach's Alpha 0.86

Table 1. Cont.

Nº	Name of the Instrument	Authors	Year	Country	Sample	Study Dimensions	Internal Consistency
8	Validation of an Empowerment and Personal Agency Scale in Mexican Women	Padilla and Cruz del Castillo [37]	2018	Mexico	155 women aged 18 to 69 years old.	Personal agency, self-awareness, health empowerment, social empowerment.	Cronbach's Alpha 0.92
9	Construction and validation of the Global Psychological Empowerment Scale for Women	Batool S.A. and Batool, S.S. [38]	2017	Pakistan	500 women	Meaning, competence, self-determination, and impact.	Cronbach's Alpha 0.66.
10	Validating an Agency-based Tool for Measuring Women's Empowerment in a Complex Public Health Trial in Rural Nepal	Gram et al. [39]	2016	Nepal	511 women in EFA 509 women in CFA	Relative Autonomy Index for measuring Amartya Sen's notion of agency freedom	External Cronbach's Alpha 0.82 Internal Cronbach's Alpha 0.90
11	Development and validation of a new tool to measure Iranian pregnant women's empowerment	Borghei et al. [29]	2015	Iran	161 pregnant women	Educational empowerment, autonomy, socio-political empowerment	Cronbach's Alpha 0.95
12	Instrument for measuring women's empowerment.	Hernández and Falconi [40]	2008	Mexico	528 women leaders	Participatory empowerment, daringness, external influences, equality, social satisfaction, security	Cronbach's Alpha 0.86

Moreover, a scale evaluating attitudes towards women's empowerment was administered to male and female Pakistani university students, demonstrating a reliability of 0.80. The study conducted an exploratory factor analysis using the Kaiser–Meyer–Olkin test, resulting in a value of 0.86 after eliminating items with loadings less than 0.30 and consolidating factors. This study concluded that the scale enables the measurement of attitudes towards empowerment [33].

Numerous authors have delved into personal agency, encompassing factors such as autonomy, self-efficacy, self-control, and self-preparation. It holds significant sway as it implies the freedom to act and achieve goals [41] and the capacity to make decisions across all areas of life [10,42]. From this perspective, scales have been devised to gauge empowerment. For instance, the "Reproductive Agency Scale" evaluates the aptitude for recognizing and exercising economic rights, making personal and family decisions, and the freedom of movement. This tool primarily centers on the decision-making capacity concerning the utilization of resources [43].

Conversely, the "autonomy scale", which assesses the ability for self-governance, emotional self-regulation, and decision making, has shed light on how women exercise self-control, subsequently influencing their personal choices and professional endeavors [35]. Moreover, other dimensions of empowerment have been explored, including socio-economic, socio-cultural, family/interpersonal, legal, and political aspects, which impact or contribute to the cultivation of resilience and democratic participation—elements integral to empowerment [44]. A study conducted in Nepal applied an enhanced version to assess the concept of agency freedom based on Amartya Sen's original tool [39].

A pivotal study examined empowerment among married immigrant women in Korean societies, scrutinizing personal capabilities, group perception, autonomy, and self-determination [45]. Intrapersonal empowerment zeroes in on autonomy and roles, while political and social empowerment encompasses aspects linked to leadership prowess and political engagement. Conversely, an instrument utilized for pregnant women by Borghei et al. [29] assessed empowerment through three dimensions: educational empowerment, autonomy, and sociopolitical empowerment, employing a 32-item questionnaire.

Several studies in Latin America have focused on scales for measuring empowerment. For instance, at the University of Juárez in Mexico, Hernandez and Falconi [40] devised a tool consisting of 34 items to assess empowerment across seven factors: participatory empowerment, temerity, external influences, independence, equality, social satisfaction, and confidence. This instrument employs a qualitative scale to gauge levels of empowerment, encompassing high, medium, and low values. The questionnaire was validated with leaders from various states of Mexico and yielded a reliability analysis of 0.863.

By comparison, Padilla and Cruz [37], from the Autonomous University of Mexico, proposed another tool consisting of 47 items distributed across four factors that assess personal agency, health empowerment, self-awareness, and social empowerment in university students. This same scale was introduced in a condensed version with 12 items allocated in the same four factors as the original tool [34]. Its recommendations center around gauging the empowerment of students from their enrolment at the university for ongoing assessment.

Another instrument for gauging women's community empowerment assesses dimensions such as participation, leadership, community interest, and personal control. The results indicated that this diagnostic scale effectively measures women's empowerment at the community level [46].

In Ecuador, existing studies on empowerment have focused on issues related to sexual and reproductive empowerment in adolescent women. These studies used data from the Ecuadorian National Health and Nutrition Survey and provided results indicating a lack of sexual empowerment in women who are mothers [47]. Furthermore, another case study conducted in a rural community identified the significance of implementing socio-educational processes and socio-economic programs that promote women's physical and mental health. The study aimed to achieve greater security, interdependence, and decision-making capacity [48].

Furthermore, Figueroa Romero [49] analyzed women's empowerment from the perspective of participation and leadership training in indigenous women. The study concluded that it is essential to reconsider women's organizational autonomy as a crucial means to their empowerment. However, no scientific studies focused on validating scales to measure the empowerment of Ecuadorian women related to training.

Considering the analyzed knowledge gaps, we proposed a scale to measure empowerment in Ecuadorian university women. The primary objective of our study was to validate an instrument enabling the measurement of women's empowerment in the university setting, applied within the Ecuadorian context. In guiding this process, four research questions were established: (1) What factors explain female empowerment in Ecuadorian universities? (2) How do women perceive gender equality? (3) How do women perceive active participation and leadership? (4) Does academic training affect the development of women's empowerment? The scale's reliability and validity were assessed, and the underlying factors were determined using structural equation modeling. The aspects considered in the scale included participatory empowerment, equality, external influence, independence, dependence, confidence, and social satisfaction. This scale, of reduced dimensions, was designed to evaluate the level of empowerment of women in their management and leadership roles.

2. Materials and Methods

2.1. Participants

Female students from four Ecuadorian universities were invited to participate in the survey. We employed a non-probability self-selection sampling method, and student participation was entirely voluntary, with participants assured that their data were confidential. No form of incentive was provided to the participants by the researchers. In total, 1478 women aged between 17 and 44 took part in the research, distributed as follows: 38.4% from the Universidad Laica Eloy Alfaro de Manabi, 28.2% from Escuela Superior Politecnica Agropecuaria de Manabi Manuel Félix López, 18% from the Universidad Tec-

nica de Manabi, and 15.4% from the Universidad Estatal del Sur de Manabi. Of the sample, 81.5% were single, 10.1% were in common-law marriages, 6.4% were married, and 2.1% were divorced or widowed women.

Additionally, 76.8% of the participants were Catholic, while 23.2% identified as Protestant. The surveyed students were enrolled in various university programs, including Social Sciences, Business Education, Agriculture, Architecture, Life Sciences, Education, IT, Services, Engineering, and Health. The sample size of 1478 surveys aligns with the conditions and considerations in structural equation modeling as analyzed by Hancock and French [47] and Thakkar [48], providing sufficient power for relevant tests of data model fit.

2.2. Instrument

This scale is an adaptation of a previous study conducted by the University of Juárez-Mexico [40], which explored empowerment through seven factors: 1. participatory empowerment (PD); 2. temerity (TD); 3. external influences (EID); 4. independence (ID); 5. equality (ED); 6. social satisfaction (SSD); and 7. confidence (CD) and 34 items (Table 2). The scale was tailored to fit the Ecuadorian context, with specific linguistic adjustments made based on expert recommendations during the review and validation process. Furthermore, the items related to the confidence dimension were consolidated with the independence dimension. Twenty-seven items from the original scale were retained, and four additional items concerning significant aspects of the country's regulations, such as sexual and reproductive rights, resource management, and women's participation in various areas, were incorporated. This adapted version, named the "Women's Empowerment Measure" (WoEm-M), comprises 31 items (Table 2). The instrument offers five levels of assessment: 1, indicating "Totally disagree" (TD); 2, "Disagree" (D); 3, "Undecided" (U); 4, "Agree" (A); and 5, "Totally agree" (TA). The primary aim of this adaptation was to analyze the behavior of the data and observe potential variations based on the statistical results.

Table 2. Original and Adapted versions of the instruments.

Item	Original Instrument (Hernández and García, 2008 [40])	Adapted Version of the Instrument (Authors)
1	<i>A leader must be proactive.</i>	<i>To exercise good leadership, one must be very active.</i>
2	<i>Good leaders are persevering.</i>	<i>To exercise good leadership, one must be persevering.</i>
3	<i>Responsibility leads us to become leaders.</i>	<i>I participate in women's associations.</i>
4	<i>The only thing I need to be a leader is to be entrepreneurial.</i>	<i>To exercise good leadership, one must be entrepreneurial.</i>
5	<i>I enjoy it when I am unique and different from other people.</i>	Not considered in the adapted instrument
6	<i>I believe it is essential for women to have their own economic income.</i>	<i>I believe it is essential for women to have their own economic income.</i>
7	<i>I feel comfortable when I am the object of praise or awards.</i>	<i>I feel comfortable when I am the object of praise or awards.</i>
8	<i>To participate politically, I have to negotiate with my father or partner.</i>	<i>I participate in political, social, and professional spheres, but I have to negotiate with my partner or a male member of my family.</i>
9	<i>It is better for the man to make crucial decisions.</i>	<i>It is better for important decisions to be made by women.</i>
10	<i>When I make decisions outside my home, I feel insecure.</i>	<i>When I make decisions outside my home, I feel insecure.</i>
11	<i>Someone always helps me decide what is good for me.</i>	Not considered in the adapted instrument
12	<i>To exercise political leadership, one must have suitable qualities.</i>	<i>To exercise political leadership, one must have suitable qualities.</i>
13	<i>Women have the capacity to hold positions of power and leadership.</i>	<i>Women have the capacity to hold positions of power and leadership.</i>
14	<i>School influences women to be able to function in positions of power or politics.</i>	<i>School influences women to be able to function in a position of power or politics.</i>
15	<i>Cultural level influences women to be able to function in positions of power or politics.</i>	<i>Cultural level influences women to be able to function in positions of power and leadership.</i>
16	<i>The family should educate women to have positions of power and leadership.</i>	<i>The family educates women to have positions of power and leadership.</i>
17	<i>It is necessary for women to have the knowledge to participate in political processes.</i>	<i>It is necessary for women to have the knowledge to participate in positions of power.</i>
18	<i>I would like to see more women access positions of power.</i>	<i>I would like to see more women access positions of power.</i>

Table 2. Cont.

Item	Original Instrument (Hernández and García, 2008 [40])	Adapted Version of the Instrument (Authors)
19	<i>My partner or parents must always know where I am.</i>	<i>My partner must always know where I am.</i>
20	<i>I try to meet the expectations or desires that my loved ones have for me.</i>	<i>My parents must always know where I am.</i>
21	<i>I feel uncomfortable when I do something that was not allowed at home.</i>	<i>I try to meet the expectations or desires that my loved ones have for me.</i>
22	<i>My happiness depends on the happiness of those close to me.</i>	<i>My happiness depends on the happiness of those close to me.</i>
23	<i>I solely decide my current life.</i>	<i>I make my own decisions in my current life.</i>
24	<i>I am satisfied with myself.</i>	<i>I decide when and how to have sex *.</i>
25	<i>Women have the ability to rule the world.</i>	<i>I decide when and how many children to have *.</i>
26	<i>I make critical decisions for my life.</i>	<i>I request approval to change my image or cut my hair.</i>
27	<i>Women have the same opportunities as men to access decision-making positions.</i>	<i>Women enjoy the same rights as men to participate and obtain positions of power and leadership.</i>
28	<i>Women enjoy the same rights as men to obtain positions of power and leadership.</i>	<i>Women have the same opportunities as men to access decision-making positions.</i>
29	<i>Women have plenty of opportunities to participate in positions of power.</i>	Not considered in the adapted instrument
30	<i>Women and men have the same opportunities to access jobs of all kinds.</i>	<i>Women have the same opportunities to access jobs of all kinds.</i>
31	<i>My family sees that I participate socially positively even if I spend less time at home.</i>	<i>My family thinks I participate socially and positively, even if I dedicate less time to them.</i>
32	<i>My work is valued and recognized.</i>	<i>My work is valued and recognized.</i>
33	<i>I have the necessary skills to participate socially.</i>	<i>I have the necessary skills to participate socially.</i>
34	<i>I chose my current career or activity without pressure.</i>	<i>I chose my current career or activity without pressure.</i>

Items of the original instrument to measure empowerment (Hernández and García, 2008 [40]). Items (*) suggested by the authors in an adapted version of the instrument.

2.3. Procedure

Data were collected online using the Office 365 Forms tool from July 2019 to February 2020. Permission and support were secured from the respective authorities to appoint an individual responsible for assisting in data collection at each higher education institution (HEI)

2.4. Data Analysis

The instrument's content was validated by a panel of scientific experts who assessed the elements for relevance, timeliness, necessity, and indispensability.

The EM estimation method was applied to test for missing values in the dataset and determine whether they were random or due to systematic errors.

For data analysis, we utilized SPSS version 27. Reliability was computed using McDonald's omega macro [50] to assess the instrument's internal consistency. McDonald's omega offers several advantages over the traditional Cronbach's alpha coefficient. Omega coefficients operate with factorial loads (weighted sum of standardized variables), provide stable calculations, offer an accurate measure of reliability, are independent of the number of items, and are suitable for items with non-normal distribution or correlated errors [51,52].

In the exploratory factor analysis (EFA), we used 739 cases (50%) out of 1478. For the confirmatory factor analysis (CFA), we used the remaining 739 cases (50%).

Regarding the exploratory factor analysis (EFA), we applied the Kaiser–Meyer–Olkin (KMO) test to assess the sample's adequacy for the study variables. A factor reduction analysis (FRA) was conducted with a varimax rotation involving 250 interactions, which helped simplify and interpret the results. To test for common method bias, we conducted Harman's single-factor test using the first segment of data employed for EFA. For the confirmatory factor analysis (CFA), we used the SPSS AMOS 24 program, employing structural and multivariate equations.

Regarding external validity, we opted for study replication by administering the validated version of the instrument after CFA to a new sample of 500 students across two of the universities with the lowest percentage of surveyed students.

3. Results

3.1. Validation Process of Content and Construct Comprehension

The validation of the instrument's content was conducted by a panel of ten experts in Gender Equality and Higher Education from the Universidad de Sevilla and the Universidad de Córdoba in Spain, along with the Universidad Técnica de Manabí and the Universidad Laica Eloy Alfaro de Manabí in Ecuador. The content was assessed against four criteria: adapted instrument presentation, selection of factors, formulation of items, and recommendations for improving the instrument. The experts concurred that the questions in the instrument did not lead to misunderstandings but suggested considering changes in specific words that implied legal or social interpretations.

The phrasing was scrutinized, considering terms that might be confusing within the Ecuadorian context considering sociological, anthropological, psychological, and axiological aspects. The understanding of the instrument was validated (pilot) with the involvement of 35 female students from the Basic Education program at the Universidad Laica Eloy Alfaro de Manabí. We utilized Office 365's Forms tool to conduct the survey, and the average time taken to complete it was 16 min and 11 s without encountering any difficulties. The instrument comprised 31 items.

3.2. Construct Validation

3.2.1. Exploratory Factor Analysis

The percentage of missing values across the variables in the study was 1%, and their presence was related to random factors ($p > 0.05$).

To conduct the exploratory factor analysis (EFA), we assessed the reliability of the dimensions included in the original instrument. The EFA results are as follows: The equality dimension displayed a w coefficient of 0.91, considered excellent. Conversely, the last five coefficients were considered questionable. External influences obtained a w of 0.67, participatory empowerment reached a w of 0.69, social satisfaction obtained a w of 0.69, and the temerity dimension obtained a low w coefficient of 0.68. Finally, the independence dimension recorded the lowest w of 0.66.

In addition to examining reliability, the McDonald's omega coefficient of each item of the instrument was evaluated, which led to the elimination of five items TD.a Participation in political, social, and professional spheres, but with the need to negotiate with my partner; TD.b Participation in political, social, professional spheres, but with the need to negotiate with a male member of my family; PD.e Participation in different public spaces such as associations, women's social groups, unions, parties politicians, business groups, and micro-business networks; ID.a My partner must always know where I am; ID.f I request approval to change my image or cut my hair. The resulting global w coefficient of 0.86 indicates good internal consistency in the instrument [53,54].

The variables underwent an exploratory factor analysis (EFA), and the Kaiser–Meyer–Olkin fit test yielded a value of 0.865, indicating a high correlation between the variables [54]. Additionally, Bartlett's test of sphericity revealed a significant correlation of 0.00 between the variables. Furthermore, the explained variance reached 60.96% [53].

We decided to exclude parameters with factorial loadings less than 0.40 in the analysis process, reducing factors using an absolute value coefficient and a varimax rotation with 250 interactions. This procedure led to a reorganization of the variables [53]. Following these criteria, the EFA resulted in the distribution of the instrument into six factors, as detailed in the following table (Table 3):

Table 3. Rotated component matrix results according to exploratory factor analysis.

N°	CODES	ITEMS	F1	F2	F3	F4	F5	F6
1	PD.a	To exhibit effective leadership, I need to demonstrate persistence.	0.736					
2	PD.c	To demonstrate effective leadership, I must be highly active.	0.729					
3	PD.d	Do you believe women must have their economic independence?	0.694					
4	PD.b	To exhibit effective leadership, I should possess entrepreneurial qualities.	0.638					
5	EID.c	Women possess the knowledge and skills necessary to engage in positions of authority.	0.498					
6	TD.c	What qualities do you think it needs to possess to engage in political leadership?	0.421					
7	ED.b	Women have the same opportunities as men to pursue various job positions.		0.919				
8	ED.c	Women have equal opportunities to access various job positions, just like men.		0.864				
9	ED.a	Women have the same rights as men to attain positions of power and leadership.		0.859				
10	ID.g	I can decide when and how to engage in sexual activities. *			0.799			
11	ID.h	I have the autonomy to decide when and how many children to have. *			0.798			
12	EID.f	Women can assume roles of authority and leadership.			0.595			
13	EID.g	I advocate for increased representation of women in positions of power.			0.565			
14	ID.e	I make decisions about how to use and allocate my monthly salary.			0.421			
15	EID.a	The cultural environment impacts women's ability to hold positions of power and leadership.				0.650		
16	EID.e	Educational institutions contribute to women's ability to assume power positions or engage in politics.				0.649		
17	TD.d	I believe it is beneficial for essential decisions to involve women.				0.598		
18	EID.d	Families play a role in educating women to take on positions of authority and leadership.				0.552		
19	EID.b	I feel at ease when I receive praise or awards.				0.535		
20	SSD.c	I chose my current career or activity without any external pressure.					0.681	
21	SSD.d	My family supports my social participation, even if it means spending less time with them.					0.666	
22	SSD.b	I receive acknowledgement and appreciation for my work.					0.661	
23	SSD.a	I possess the necessary skills to engage socially.					0.530	
24	ID.d	I strive to meet the expectations or desires of my loved ones.						0.794
25	ID.c	My happiness is influenced by the well-being of those close to me						0.794
26	ID.b	My parents usually expect to be informed of my whereabouts.						0.670

Items of the instrument to measure empowerment (Hernández and García, 2008 [40]). Items (*) suggested by the authors.

As per the exploratory factor analysis (EFA), empowerment was assessed using six factors by rearranging the variables.

3.2.2. Confirmatory Analysis

According to Thakkar [55], structural equation modeling is considered one of the most effective confirmatory strategies. Confirmatory analysis was applied to 739 university students using the AMOS structural equation model.

The statistical analysis led to the identification of two models. In the first model, 24 variables were distributed across six factors, excluding variables with a factor loading below 0.5 [53]. Consequently, two models were developed to determine the best fit. Model A involved a distribution of variables ranging from five to three per dimension, while Model B distributed variables between seven and two per dimension.

Model A yielded an Absolute Fit Bond Index, obtaining a chi-square value of <0.00 when ideally it should be >0.05 . In his book on structural equation modeling, Thakkar states that an acceptable range for a CMIN/DF value is between 2 to 3 [55], and in Model A it was 3.144, rendering this model unacceptable. The Goodness of Fit Index (GFI) of 0.908 suggests that the model could still be adjusted. The root mean square error of approximation (RMSEA) yielded a p -value of 0.054, which, although not less than <0.05 , still suggests a potential model fit. The standardized root mean square residual (SRMR) and its p -value of 0.0607 indicated a lack of fit [56].

The adjusted goodness of fit index (AGFI) yielded a value of 0.888, below the acceptable threshold (>0.90), indicating poor model fit [57]. Similarly, the normed fit index (NFI) measure yielded a value of 0.866, failing to meet the >0.90 criterion, rendering it unacceptable. The comparative fit index (CFI) obtained a score of 0.904, affirming model fit. The incremental fit index (IFI) scored 0.905, suggesting good model fit. As Model 1 did not meet all criteria, it was decided to modify it following recommendations from various authors [54,55].

Model B is presented with an adjustment in the participative empowerment and independence dimensions. The chi-square value does not align; hence, the CMIN/DF value of 2.612 was used as a reference, which is considered acceptable [51]. The absolute and relative goodness indices (RMSEA: 0.047, SRMR: 0.05, GFI: 0.936, AGFI: 0.918, NFI: 0.905, IFI: 0.939, TLI: 0.927, CFI: 0.938) indicate that the model fits better.

As an outcome of this confirmatory stage, the dimension of “Boldness” is mostly eliminated, leaving only the variable TD.d “It is better for important decisions to be made by the woman” in the dimension of “External Influences”, implying a process of ownership in decision making. Furthermore, the dimension of “Independence” is explained by two variables related to ownership of one’s body, which is a significant departure from the original instrument.

Figure 1 shows that both models consist of 24 variables distributed across six factors. The observed difference pertains to the grouping of variables and their factor loading, which is improved in Model B (see Tables 4 and 5). The statistical conditions indicate that Model B exhibits a good fit, thus supporting the validity of an instrument measuring the empowerment of university women.

Table 4. Summary of WoEm-M confirmatory models.

Parameters	Expected Value	Model A	Decision	Model B	Decision
Chi-square	>0.05	0.000	-	0.00	-
D.f.	2–3	3.144	-	2.612	Good fit
RMSEA	<0.05	0.054	-	0.047	Good fit
SMRS	<0.05	0.06	-	0.050	Good fit
AGFI	>0.90	0.888	Could be fitted	0.918	Good fit
GFI	>0.90	0.908	Good fit	0.936	Good fit
CFI	>0.90	0.904	Good fit	0.938	Good fit
NFI	>0.9	0.866	Could be fitted	0.905	Good fit
IFI	>0.9	0.905	Good fit	0.939	Good fit
TLI	>0.9	0.891	-	0.927	Good fit

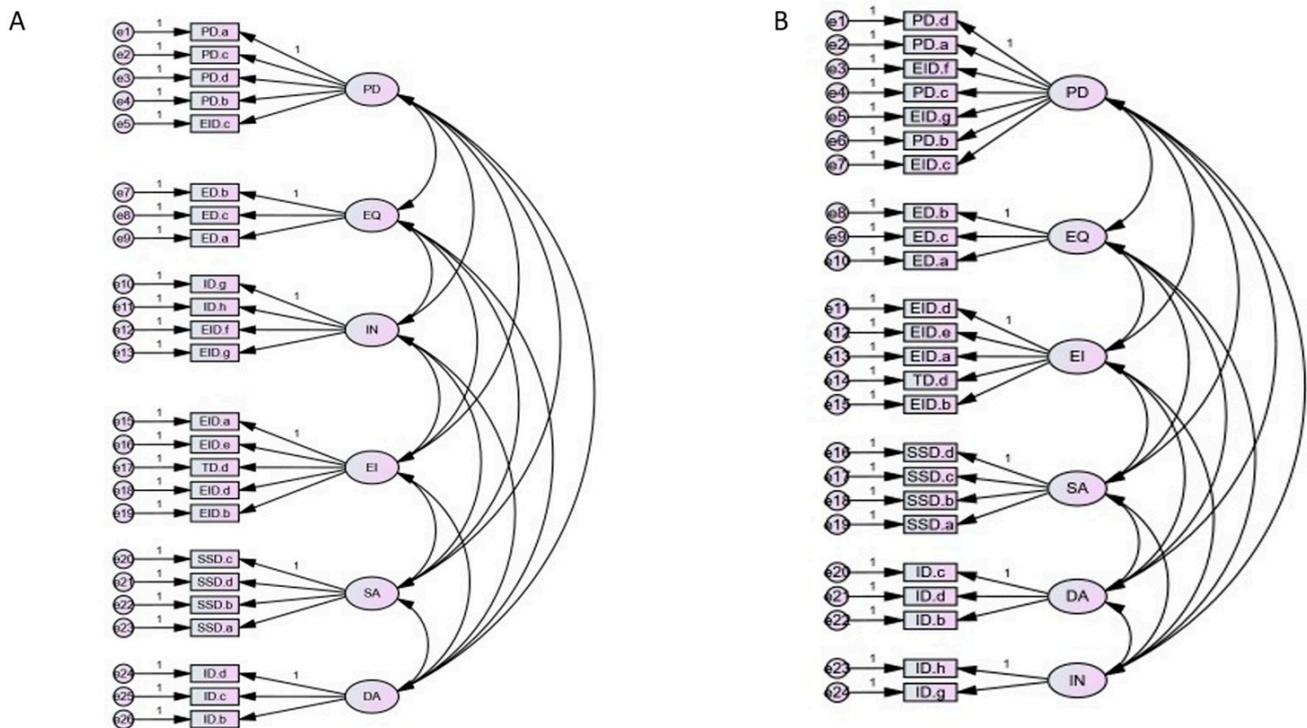


Figure 1. Distribution of variables diagram of confirmatory models. (A). First model obtained after CFA. (B). Good model fit.

Table 5. Definitive scale according to confirmatory factor analysis. Factor loading for Models A and B.

Dimension	Model A Code	Factor Loadings	Dimension	Model B Code	Factor Loading
PD	PD.a	0.719	PD	PD.d	0.784
PD	PD.c	0.644	PD	PD.a	0.75
PD	PD.d	0.776	PD	EID.f	0.773
PD	PD.b	0.553	PD	PD.c	0.707
PD	EID.c	0.554	PD	EID.g	0.705
ED	ED.b	0.959	PD	PD.b	0.568
ED	ED.c	0.829	PD	EID.c	0.595
ED	ED.a	0.804	ED	ED.b	0.939
IN	ID.g	0.523	ED	ED.c	0.882
IN	ID.h	0.542	ED	ED.a	0.828
IN	EID.f	0.886	EID	EID.d	0.639
IN	EID.g	0.881	EID	EID.e	0.613
EID	EID.a	0.461	EID	EID.a	0.447
EID	EID.e	0.616	EID	TD.d	0.49
EID	TD.d	0.478	EID	EID.b	0.444
EID	EID.d	0.656	SA	SSD.d	0.465
EID	EID.b	0.516	SA	SSD.c	0.484
SA	SSD.c	0.507	SA	SSD.b	0.616
SA	SSD.d	0.451	SA	SSD.a	0.75
SA	SSD.b	0.582	DA	ID.c	0.631
SA	SSD.a	0.705	DA	ID.d	0.771
DA	ID.d	0.781	DA	ID.b	0.503
DA	ID.c	0.665	IN	ID.h	0.806
DA	ID.b	0.527	IN	ID.g	0.811

3.2.3. External Validity of the Instrument

The results of the study replication by administering the validated version of the instrument to a new sample of 500 students across two universities showed a similar level of reliability according to CFA with $w = 0.85$.

3.2.4. General Aspects of the Validation of the Model

It is worth noting that the sample size was one of the crucial factors in validating the scale, with the participation of 1478 women from four universities in Zone 4 of Ecuador. This ensured that the conditions were met to conduct both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). This instrument provides a deeper understanding of female empowerment, which should be assessed from a diverse perspective. It allows exploration of how women conceptualize power, leadership, decision making, personal development, and equal opportunities as fundamental aspects of their rights.

The CFA revealed that the statistically best-fitting model consists of 24 items distributed across six distinct factors. Additionally, a seventh factor related to the dimension of audacity was identified, standing out in the exploratory factor analysis. This factor assesses women's involvement in various contexts and how it entails negotiation with the men in their families. Participation is considered a fundamental principle and right, as established by Human Rights and the Political Constitution of Ecuador [58]. It should be free and spontaneous, without conditions, progressively fostered from childhood.

Women's participation in educational, social, political, and social movement spheres is crucial for their empowerment and implies that in all the realms they engage with, they can express themselves freely and participate in decision making.

4. Discussion

The study focused on female university students in higher education institutions in Ecuador. We thoroughly searched for the application of instruments measuring female empowerment, analyzing each instrument's dimensions, research methodology, and findings; this led us to conclude that the instrument proposed by Hernandez and Falconi [40] is the most suitable for adaptation to the Ecuadorian context and to other countries with similar characteristics because it allows critical reflection, future planning, identification of workplace barriers, women's role in the public sphere, and changing power structures.

The validated instrument identifies six factors explaining women's empowerment in the university context. According to the reviewed literature, several research experiences have studied women in different contexts. Therefore, it is crucial to begin with diagnostics that allow us to recognize situations that may affect women and ensure conditions of equality. The validated instrument encompasses factors that can elucidate female empowerment in Ecuadorian contexts and in other countries undergoing the process of transforming towards more equitable societies like ours. These factors include political participation and leadership, gender equality, independence, external influences, social satisfaction, and dependent attitudes.

These factors have also been examined by other authors, such as Al-Qahtani et al. [31], Borghei et al. [29], Padilla Gámez et al. [34], Shuja et al. [33], and Sinharoy et al. [30], who have analyzed women's empowerment in university, community, and family settings to comprehend the processes of attitude changes that lead women to make decisions.

One of the crucial factors in measuring female empowerment is participation, assessed through the exercise of one's own rights and those of other women. In our validated instrument, within the dimension of participatory empowerment, there are seven variables: PD.a "To exert good leadership, one must be persevering", PD.b "To exert good leadership, one must be entrepreneurial", PD.c "To exert good leadership, one must be very active", PD.d "I believe it is important for women to have their own economic income", EID.c "Women need to have knowledge to participate in positions of power", EID.f "Women have the capability to hold positions of power and leadership", and EID.g "I would like to see more women accessing positions of power".

Political participation and leadership represent a challenge in Ecuador as, despite policies favoring gender equality, a patriarchal system persists that limits the visibility of women in leadership roles. In the university context, positive trends in women's participation are observed, although parity, as established by the Constitution, has not yet been achieved [22,59,60]. For this reason, the items in this dimension determine the perception of attitudes they have about themselves in leadership matters, corresponding to the challenges of generating creative ideas and solutions in aspects related to their profession and daily life; these ideas are supported by another study conducted by Bin Bakr and Alfayez [22], which emphasizes the importance of developing skills to reinforce their self-confidence and be capable of breaking barriers to assume new roles.

It is essential to diagnose the sense of sisterhood among women [58]; hence, the instrument includes: "I would like more women to access positions of power" and "Women can occupy leadership positions". These factors reveal how women think about others of the same gender, enabling the identification of perceptions regarding inequalities, fostering understanding and the exchange of experiences without judgment, among other aspects related to their gender. These elements facilitate collaboration towards common goals that transform a destined university dynamic.

Consequently, this new adjustment is directly related to the exercise of the right to participation, leadership qualities, and the responsibilities associated with managerial roles. The three variables that were originally located in the "External Influences" dimension are now grouped under "Participatory Empowerment", which has implications for understanding women's participation in managerial and leadership positions. This enables the examination of these perceptions, as it is crucial to comprehend how women perceive themselves and other women [6,19]. Educational institutions, such as universities, play a crucial role in promoting active participation of women, enhancing their leadership capabilities, and fostering attitudes that empower them to represent student groups and take on significant roles within higher education institutions [22,26,61].

Another vital aspect in measuring the empowerment of university women is understanding how they perceive gender equality, such as the right to access, equal academic opportunities, and participation in leadership representations. For this reason, the equality dimension, which includes the following variables assessing equal opportunities—ED.a "Women have the same rights as men to attain positions of power and leadership", ED.b "Women have the same opportunities as men to access decision-making positions", and ED.c "Women have the same opportunities to access jobs of all kinds"—focuses on exploring women's perception regarding gender equality principles and equal opportunities.

This dimension holds the potential to identify trends, patterns, and differences in perception among various demographic groups, which, in turn, can be pivotal in designing policies that promote gender equality and the elimination of gender discrimination in the university environment [2,3,7,11]. Regarding the original instrument, no changes have been made, thus enabling the evaluation of women's perception regarding gender equality.

Gender equality is a fundamental principle supported by human rights and is a key goal of the Sustainable Development Goals (SDGs), and especially SDG number five [5]. Ecuador has a responsibility to promote gender equality in all areas. For this reason, the proposed instrument evaluates perceptions about gender equality in issues related to participation, leadership, and employment. It includes statements such as: "Women enjoy the same rights as men to participate and access positions of power and leadership", "Women have the same opportunities as men to access decision-making positions", and "Women have the same opportunities to access jobs of all kinds".

Identifying these perceptions is crucial for understanding possible misconceptions or misinformation that women may have. It is also essential for recognizing situations of inequality in their environment and highlighting their competence in academic and work settings. This, in turn, can drive the promotion of policies, academic programs, and affirmative actions aimed at reducing gender gaps and promoting equal opportunities, not

only in educational spaces but also at the community level, where more women could be engaged in these understandings [62,63].

The participation of women in various domains has been a historical and ongoing process. Hence, it is crucial to understand the factors that influence women to pursue education and actively engage in the university environment, as well as other areas of their choosing. The instrument includes the dimension of “External Influences”, composed of the following variables: EID.d “The family educates women to hold positions of power and leadership”, EID.e “The school influences women to be able to thrive in a position of power or politics”, EID.a “Cultural level influences women to excel in positions of power and leadership”, TD.d “It is better for important decisions to be made by the woman”, and EID.b “I feel comfortable when I receive praise or awards”. External influences encompass all those factors that directly or indirectly impact the empowerment process of women. In this context, this dimension undergoes a regrouping with five variables, one of which originally belonged to the “Boldness” dimension, addressing significant decisions that a woman would undertake. The implications that resume this dimension concern the relevance of the family and the university environment in developing the necessary competencies to have a discourse reflecting knowledge. Therefore, it is necessary to study the cultural contexts [61,64] because it is there that gender stereotypes reside. Furthermore, education allows women to develop skills and knowledge, enabling them to compete in the workplace and actively participate in society, making informed decisions. These assertions are also supported by Tiwari and Malati [63], who argue that women who receive education, whether formal or informal, are more likely to contribute effectively to society. It is worth noting that Sustainable Development Goals (SDGs) 4 and 5 underscore the commitment made by states to achieve their targets. Therefore, it is crucial to understand how women perceive the influence of their family on their decisions and how this promotion of education allows them to choose the careers they desire and thrive in spaces of their choosing.

The dimension termed “Social Satisfaction” groups together four variables: SSD.a “I have the necessary skills to participate socially”, SSD.b “My work is valued and recognized”, SSD.c “I chose my current career or activity without any pressure”, and SSD.d “My family approves of my social participation, even if it means I spend less time with them”. It has not undergone any changes and remains the same as in the original instrument. This dimension enables the measurement of empowerment concerning a person’s satisfaction in various aspects of their life, such as social relationships, work, career choice, family relations, and financial control. It involves understanding how individuals feel about their life in society and how they perceive their ability to make decisions and control their environment. Notably, this set of variables measures the perception of female empowerment from the perspective of social satisfaction, which can be relevant in studies examining the quality of life and overall well-being of women in the university setting [22,28,63]. These aspects are scrutinized by researchers examining women’s empowerment in nursing, underscoring the importance of society’s recognition of their work and the development of gender awareness in academic training [64].

Dependent attitudes are linked to attitudes, beliefs, and behaviours in which women have been taught and learned to rely on others, typically men or power structures, which limits their capacity to make their own decisions [65,66]. This confirmatory analysis groups three variables under “Dependent Attitudes”. These variables include: “I feel that my parents must know my whereabouts at all times”, “My level of happiness is tied to the happiness of those close to me”, and “I strive to meet the expectations and desires of my loved ones”. These situations reflect characteristics specific to the Latin American context and stem from the influences of culture and traditional social norms that are closely linked to the perception of happiness. Additionally, they are affected by the social and familial pressure that influences women’s attitudes and behaviours.

Studying these attitudes is important because, through education, cultural patterns that have normalized specific roles and expectations for women can be analyzed and questioned; this can be achieved by including subjects that encourage reflection on the im-

portance of women's autonomy and independence and understanding how these attitudes can impact their development and participation in society. This analysis contributes to the promotion of gender equality and the empowerment of women in the cultural and social context in which they operate [8,11,14,28].

Finally, the dimension of independence, which has undergone a regrouping of two variables—"I decide when and how to have sexual relations" and "I decide when and how many children to have",—considers a person's capacity to make autonomous decisions and have control over important aspects of their life, such as their sexual life and family planning. This dimension may be relevant in studies examining individuals' autonomy in matters related to their intimacy and reproductive health and can help better understand attitudes and perceptions surrounding these areas [67,68].

In addition, a similar study conducted in Egypt examines female empowerment and provides evidence of situations affecting women concerning their reproductive health and violence against them. The study determines that women with access to education and jobs tend to be more empowered, which is reflected in their partners, who are also in a similar situation [64]. In this sense, for future research, it would be essential to consider the identification of university women who are single mothers as a demographic aspect.

Limitations of the Study and Further Research

The perception of women regarding the limited relevance of female empowerment processes and the right to gender equality, predominantly understood as a struggle against the male gender rather than an integral part of their personal development, could be considered a limiting factor of the present study. In addition, increasing the sample size and implementing the instrument in higher education institutions from other regions of Ecuador would allow for the determination of similarities and differences in the perceptions of other groups of students.

5. Conclusions

Our study aimed to validate an instrument designed to measure women's empowerment in the university setting, specifically in the Ecuadorian context. To achieve this, we validated an instrument consisting of six dimensions and 24 items, allowing for the measurement of women's empowerment in Ecuador.

One of the main objectives of our research was to identify the factors that explain women's empowerment in Ecuadorian universities. We concluded that empowerment is influenced by participative empowerment, gender equality, external influences, social satisfaction, and dependent and independent attitudes. Additionally, we observed that these factors may be affected by variables such as age, marital status, religion, and academic field of study.

Regarding women's perception of gender equality, our findings indicate that this equality is perceived through equal opportunities provided within the family sphere, but these opportunities may be conditioned by dependent attitudes rooted in Ecuadorian culture. The importance of equal participation in leadership and positions of power is also emphasized.

In relation to women's active participation and leadership, we observed that participation in association spaces is limited, which limits the opportunity to explore their leadership abilities. However, we also identified that through participation and leadership, women enhance their understanding of crucial aspects of decision-making independence and their perception of themselves as individuals with rights in leadership and political participation.

Regarding whether academic education influences the development of women's empowerment, our study demonstrates that education plays a fundamental role in the empowerment of university women. This empowerment begins in households and is strengthened in educational environments; this underscores the importance of reimagining education inclusively, encouraging women to actively engage in decision-making processes. Our study has confirmed that emotional, familial, and economic factors influence

the development of dependent attitudes in women, which persist in Ecuadorian higher education. These attitudes are primarily linked to factors such as age, marital status, and religion, which negatively impact the processes of female empowerment. Furthermore, they shed light on women's sexuality and decision making regarding their sexual and reproductive rights.

Finally, the application of this instrument, its repeated use, and the obtained results would enable universities to make meaningful decisions regarding the formulation of internal policies and affirmative actions in favor of equality, as well as the establishment of leadership programs that foster the development of female empowerment and their involvement in political and social spheres.

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