Chapter 1 / Capítulo 1

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Habitability and post-mining collective memory in Concordia, Sinaloa: Preliminary psychometric properties of a scale of memory, heritage and living conditions

Habitabilidad y memoria colectiva post-minería en Concordia, Sinaloa: propiedades psicométricas preliminares de una escala de memoria, patrimonio y condiciones de vida

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ABSTRACT

Mining has shaped the settlement, architecture and everyday life of many localities in western Mexico, and its traces persist in buildings, landscape and residents' memory. This instrumental, cross-sectional and exploratory study examined the preliminary psychometric properties of a fifteen-item scale with three dimensions, shared memory of mining, appraisal of mining heritage and living conditions, administered in the pilot survey of project FZ-HAB-0022 of the Factoriza UAS platform among adults living in Concordia, Sinaloa, Mexico. A preliminary cut of 10 cases, out of a target of 100, was analyzed with descriptive statistics, item analysis, Cronbach's alpha and McDonald's omega, Pearson inter-item and Spearman inter-dimension correlations; exploratory factor analysis was run but could not be interpreted because the correlation matrix was not of full rank. Pride in the mining past received the most favorable ratings (M = 4.10), while the wish to move to another city, street safety and job opportunities received the least favorable ones. Internal consistency was acceptable for heritage appraisal (α = .713) and low for shared memory (α = .462) and living conditions (α = .542); omega could not be interpreted in any dimension because the recoded reverse-worded item correlated negatively with the rest of its dimension. Memory and heritage appraisal were positively related (ρ = .617), with an interval that included zero. The reverse-worded items must be revised and the structure examined with the final cut.

Keywords: mining heritage; collective memory; habitability; psychometric properties

RESUMEN

La minería ha modelado el poblamiento, la arquitectura y la vida cotidiana de numerosas localidades del occidente de México, y sus huellas permanecen en los edificios, el paisaje y la memoria de sus habitantes. Este estudio instrumental, transversal y exploratorio examinó las propiedades psicométricas preliminares de una escala de quince reactivos, con tres dimensiones, Memoria compartida de la minería, Valoración del patrimonio minero y Condiciones de vida en Concordia, aplicada en el levantamiento piloto del proyecto FZ-HAB-0022 de Factoriza UAS a personas adultas residentes en Concordia, Sinaloa. Se analizó un corte preliminar de 10 casos, de una meta de 100, con estadísticos descriptivos, análisis de reactivos, alfa de Cronbach y omega de McDonald, correlaciones de Pearson entre reactivos y de Spearman entre dimensiones; el análisis factorial exploratorio se ejecutó, pero no pudo interpretarse porque la matriz de correlaciones no es de rango completo. El orgullo por el pasado minero obtuvo la valoración más favorable (M = 4.10), y el deseo de irse a otra ciudad, la seguridad en las calles y las oportunidades de trabajo, las menos favorables. La consistencia interna fue aceptable en Valoración del patrimonio minero (α = .713) y baja en Memoria compartida (α = .462) y Condiciones de vida (α = .542); el omega no fue interpretable en ninguna dimensión, porque el reactivo inverso recodificado se correlacionó en negativo con el resto. La memoria y la valoración del patrimonio se relacionaron en positivo (ρ = .617), con un intervalo que incluyó el cero. Los reactivos inversos deberán revisarse y la estructura examinarse con el corte final.

Palabras clave: patrimonio minero; memoria colectiva; habitabilidad; propiedades psicométricas

INTRODUCTION

For centuries, mining has shaped the settlement patterns, architecture and everyday life of many localities in western and northern Mexico. When extractive activity declines or changes form, its traces remain in the buildings, in the landscape and in the memory of the people who live in these places, and they raise questions about the relationship between the industrial past and present-day quality of life.

Research on post-industrial territories has shown that the identity of mining communities can be organized around a shared past even when the industry that defined them has disappeared (Walker, 2021), and that mining heritage can become a resource for community participation (Ordaz Bulos and Sánchez Fonseca, 2024) or an instrument of protest against the loss of memory and landscape associated with mining (Arista Castillo and Barrera Fernández, 2022).

Concordia, in southern Sinaloa, is one such locality. Regional historiography documents that the Compañía Minera de Pánuco, founded in 1877, reached its peak during the Porfiriato and declined toward the mid-twentieth century, in a period marked by revolutionary conflicts, international economic crises and labor stoppages; it also records that some mines in the municipality, such as those of Santa Lucía, were later organized as cooperatives (Rodríguez Pérez, 2019).

This history is part of the built landscape and of local identity, but its presence in the experience of current residents has not been systematically studied.

The relationship between the mining past and livability is not straightforward. In a peripheral industrial region of Germany, residents expressed positive views of their family ties to industry and of its role in regional history, yet described the factories and production complexes through an “eyesore” narrative, without connecting these positive associations to the physical remains (Bockelmann, 2023).

In Chuquicamata, Chile, the official heritage narrative of the mining camp centered on the figure of the male miner and rendered invisible the memories of women and their spaces of care and organization (Olivares Contreras and Cornejo Nieto, 2025).

In Minas de Riotinto, Spain, residents showed favorable affective attitudes toward mining tourism, although they differed in their cognitive and behavioral attitudes (Porras Bueno et al., 2024). The memory of the mining past, the appreciation of its heritage, and satisfaction with current living conditions can therefore vary independently.

In Sinaloa, research on heritage and habitability has focused on Mazatlán, where studies have documented the effects of tourism on the built heritage of the Historic Center (Castillo Romero, 2023) and the processes of touristification and tourism gentrification in the city (Mendieta Vega and Roldán Clarà, 2024).

Mountain communities with a mining past, such as Concordia, have received less attention, and no instruments are available for jointly recording mining memory, heritage valuation, and the perception of living conditions among their inhabitants. Before such an instrument can be used to describe the population or to relate its dimensions to other variables, it requires evidence of its psychometric functioning.

For this purpose, project FZ-HAB-0022 of the Factoriza UAS platform, classified under the psychometric track of the article workshop, designed the Scale of Mining Memory, Heritage and Habitability in Concordia. Its fifteen items are organized into three dimensions: Shared Memory of Mining, Valuation of Mining Heritage, and Living Conditions in Concordia. This article presents the results of its pilot survey, based on a preliminary data cutoff of 10 cases.

The overall objective was to examine the preliminary psychometric properties of the scale in adults residing in Concordia, Sinaloa. The specific objectives were: (a) to describe the distribution of responses to each item; (b) to estimate the internal consistency of each dimension using alpha and omega coefficients and to identify items that behaved discrepantly; (c) to assess the feasibility of an exploratory factor analysis with the available sample size; (d) to describe the correlations among the items within each dimension and among the three dimensions; and (e) to identify the aspects of the instrument that should be revised before the final data cut. The project did not state any hypotheses, so the study is exploratory in scope.

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DEVELOPMENT

COLLECTIVE MEMORY IN POST-MINING COMMUNITIES

Collective memory refers to the representations of the past that a group shares and transmits, and in mining communities it tends to be organized around work, family, and place.

In a former coal-mining village in the South Wales valleys, Walker (2021) found that everyday relationships rested on an assumed shared history, tied to an idealized image of a "typical" mining community that presented the past as uniform, and that these imagined histories were used to draw social boundaries between those who belong and those who do not.

In that analysis, memory takes both material and immaterial forms, is emotional as well as verbal, and is at once shared and imagined.

Mining memory is not homogeneous. In Chuquicamata, the recovery of women's affective counter-memories showed that officially recognized heritage may omit spaces and experiences that the community itself considers meaningful (Olivares Contreras and Cornejo Nieto, 2025).

El Bordo, in Pachuca, is a landscape where mining has operated for more than five centuries and whose heritage elements have historically been undervalued. There, a participatory process involving local residents led to the resignification of this heritage through a citizen laboratory and an architecture-for-memory project (Ordaz Bulos and Sánchez Fonseca, 2024).

These experiences suggest that the shared memory of mining combines family narratives, recognition of community history, knowledge of places, and the perception that this history is being preserved or lost.

The instrument's Shared Memory of Mining dimension captures precisely these components: stories about mining told within the family (R1), the recognition of mining as part of the community's history (R2), the shared recollection of the mining era (R3), the perception that Concordia's mining history is being forgotten (R4, reverse-scored), and knowledge of places linked to mining (R5).

APPRECIATION OF MINING AND INDUSTRIAL HERITAGE

Residents' valuation of industrial heritage has been studied from the perspectives of environmental psychology and planning. In a survey of 385 visitors to a former factory complex in Changchun, China, repurposed as a cultural district, perceived value, environmental awareness, social identity and perceived government support were associated with willingness to participate in and pay for conservation; place attachment partially mediated these relationships (Fu and Dong, 2025).

In Quanzhou, multisensory perception and involvement with historic buildings were associated with place attachment and with the intention to support the heritage destination (Cai et al., 2025). In the ancient city of Pingyao, research has examined how the emotions and actions of residents in a heritage tourism destination evolve from conflict to co-creation (Xing, 2026).

Appreciation of mining heritage may nevertheless coexist with the rejection of its material remains. In the Vogtland region, Bockelmann (2023) found that the industry's intangible heritage, associated with family history and regional prosperity, was viewed positively, whereas its tangible heritage was perceived mainly as a burden and was described through an "eyesore" narrative.

In Cerro de San Pedro, San Luis Potosí, a cultural festival that originated as a protest forum against the loss of memory, identity and landscape associated with mining drifted toward leisure, and only a minority of attendees were familiar with the town's history or the mining conflict (Arista Castillo and Barrera Fernández, 2022).

The instrument's Valuation of Mining Heritage dimension covers the conservation of mining buildings (R6), pride in the mining past (R7), the perception that mining remains make the town unsightly (R8, reverse-scored), the desire for visitors to learn about the mining history (R9), and the role of mining heritage in Concordia's identity (R10).

PLACE ATTACHMENT AND LIVING CONDITIONS IN MINING TERRITORIES

Place attachment has been defined as the affective, cognitive and behavioral bond that a person or group establishes with a meaningful environment, and its measurement remains a developing field.

Boley et al. (2021) cautioned that the variety of scales and items makes it difficult to compare

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results across communities. A systematic review of research published between 2010 and 2021 likewise concluded that there is no consensus on its measurement and that its dimensions do not behave in the same way with respect to behavioral intentions (Dang and Weiss, 2021).

The review by Kamani Fard and Paydar (2024) noted that social interaction and local features expressing history and culture are associated with a stronger bond. In the Chinese-language literature, Xiang et al. (2022) grouped the components of attachment among residents of a historic neighborhood into emotional, social, and material bonds.

In mining areas, attachment coexists with economic and environmental uncertainty. In an opencast coal mining region in western Germany, a survey of 620 residents and resettled people found high levels of psychological distress, higher still in villages threatened by resettlement. The authors associated the degradation and loss of the home environment with a higher prevalence of depressive, anxiety and somatoform symptoms (Krüger et al., 2022).

Among rural households in hazard-prone areas of China, place dependence was negatively associated with the intention to relocate (Qing et al., 2022).

These results show that the desire to stay or leave depends on the assessment of living conditions as much as on the emotional bond with the place. The instrument's Living Conditions in Concordia dimension captures enjoyment of living in Concordia (R11), the availability of daily necessities (R12), job opportunities (R13), the desire to move to another city (R14, reverse-scored), and perceived safety on the streets (R15).

VALIDITY EVIDENCE AND INTERNAL CONSISTENCY IN SHORT SCALES

The internal consistency of a dimension is usually estimated with Cronbach's alpha (Cronbach, 1951), which assumes equivalent loadings across items; McDonald's omega (McDonald, 2013) does not make this assumption, and simulation studies have compared the performance of the two coefficients under different data conditions (Malkewitz et al., 2023).

Internal structure is examined through exploratory factor analysis, for which current recommendations call for checking data adequacy and ensuring a sufficient sample size before interpreting its results (Ferrando et al., 2022; Goretzko et al., 2021).

Scales that combine direct and reverse-worded items may show wording-related biases, because some respondents respond inconsistently to the positive and negative items of the same dimension (Steinmann et al., 2022). Identifying these responses may reduce such biases (García-Batista et al., 2021). These references are relevant to an instrument with one reverse-worded item in each dimension, administered in a data cut of ten cases.

METHODOLOGY

DESIGN

An instrumental study with a quantitative approach, a cross-sectional design and an exploratory scope was conducted to examine the preliminary psychometric properties of a scale. Because the design was cross-sectional, the reported relationships are associations and do not allow causal inferences.

POPULATION, SAMPLE AND DATA CUTOFF

The data come from the survey "Piloto Concordia · Memoria minera y habitabilidad" (LEV-0027) of project FZ-HAB-0022 on the Factoriza UAS platform, and from the frozen dataset DST-0046, with a cutoff date of 16 October 2026. The survey population consists of people aged 18 years or older residing in Concordia, Sinaloa, in the municipal seat and in localities selected by the project lead.

Table 1 presents the sample composition. Twenty people opened the questionnaire, 10 completed it, no cases were excluded by the platform's quality control, and 10 cases with 15 items were analyzed. This is a preliminary data cut: n = 10 out of a target of 100, with data collection still open. The results reported in this article describe that data cut and should not be regarded as definitive.

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Table 1. Sample composition.

Indicator	Value
People who opened the questionnaire	20
Completed questionnaires	10
Cases excluded by quality control	0
Cases analyzed	10
Items	15

Note. Survey "Concordia Pilot · Mining Memory and Habitability" (LEV-0027); population: individuals aged 18 years or older residing in Concordia, Sinaloa; territory: municipal seat and localities selected by the project lead. Dataset DST-0046, hash 7b2c2d5b3c3f6018. Source: Factoriza UAS. Preliminary cutoff: n = 10 of a target of 100, with data collection still ongoing.

INSTRUMENT

The Scale of Mining Memory, Heritage, and Livability in Concordia consists of fifteen items with a 5-point response scale ranging from Strongly disagree to Strongly agree. The items are organized into three dimensions of five items each: Shared Memory of Mining (R1 to R5), Appreciation of Mining Heritage (R6 to R10), and Living Conditions in Concordia (R11 to R15).

Each dimension includes one reverse-worded item: the perception that mining history is being forgotten (R4), the perception that the remains of mining make the town unsightly (R8), and the desire to move to another city (R14). These items are already recoded in the data matrix, so a high value indicates a favorable position on every item. Table 2 presents the wording of each item.

Table 2. Structure of the instrument.

Code	Item	Reverse-scored
R1	In my family, stories are told about mining in Concordia	No
R2	Mining is part of my community's history	No
R3	We, the inhabitants of Concordia, remember the mining era	No
R4	The mining history of Concordia is being forgotten	Yes
R5	I know places in Concordia linked to mining	No
R6	The mining buildings of Concordia deserve to be preserved	No
R7	I am proud of Concordia's mining past	No
R8	Mining remnants make the town look ugly	Yes
R9	I would like visitors to learn about the mining history of Concordia	No
R10	Mining heritage gives Concordia its identity	No
R11	I like living in Concordia	No
R12	In Concordia, I find what I need for my daily life	No
R13	Concordia offers job opportunities to its inhabitants	No
R14	I would like to move to another city	Yes
R15	I feel safe on the streets of Concordia	No

Note. R1 to R5 = Shared memory of mining; R6 to R10 = Appreciation of mining heritage; R11 to R15 = Living conditions in Concordia. The dimension column is omitted to preserve the readability of the table. 5-point response scale (Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree). Reverse-scored items have already been recoded in the supplied data matrix. Source: Factoriza UAS, project FZ-HAB-0022, survey LEV-0027, dataset DST-0046.

PROCEDURE

The questionnaire was administered through the Factoriza UAS platform, which records explicit online informed consent before the first question and does not collect data that could identify individuals. The platform runs a quality control check on completed questionnaires before adding them to the dataset; at this data cut-off, it excluded no cases.

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DATA ANALYSIS

Factoriza UAS calculated the descriptive statistics for each item (mean, standard deviation, skewness, kurtosis, and percentages of responses at the minimum and maximum values). It also calculated the internal consistency of each dimension using Cronbach's alpha (Cronbach, 1951), the corrected item-total correlation, the alpha if item deleted, and the Pearson correlations among the items of each dimension, with 95% confidence intervals obtained through Fisher's z transformation.

The complementary analyses were run with the program analisis_psicometrico.py, version 1.0, in Python 3.13.16 (Python Software Foundation, 2026), with NumPy 2.5.3 (Harris et al., 2020), SciPy 1.18.1 (Virtanen et al., 2020), and pandas 3.0.5. The internal consistency of each dimension was estimated with Cronbach's alpha and McDonald's omega total (McDonald, 2013), derived from a one-factor minimum residual model and without reverse-scoring items.

The program also ran the exploratory factor analysis of the 15 items using the 10 complete cases: the Kaiser-Meyer-Olkin measure of sampling adequacy (Kaiser, 1974), Bartlett's test of sphericity (Bartlett, 1950), parallel analysis with 100 simulations to determine the number of factors (Horn, 1965), minimum residual extraction, and oblimin rotation.

Relationships between dimensions were estimated using Spearman's correlation coefficient between the mean scores of each dimension, with its 95% confidence interval obtained by the Fisher transformation with the standard error of Bonett and Wright (2000). No items were removed, and no confirmatory factor analysis was performed.

With 10 cases for 15 items, the correlation matrix is not of full rank and cannot be inverted, so the software could not compute the Kaiser-Meyer-Olkin measure or Bartlett's test, which are reported as unavailable in its output log.

Under these conditions, the factor solution cannot be meaningfully interpreted, and methodological recommendations advise against its use (Ferrando et al., 2022; Goretzko et al., 2021). Therefore, the exploratory factor analysis is neither presented nor interpreted in this article; its full output is retained in the reproducibility appendix as a record of the procedure.

ETHICAL CONSIDERATIONS

Participation was voluntary, with express informed consent recorded online through the platform, which does not collect names, addresses or other identifying data. Data were analyzed in aggregate form.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

The following tools were used in preparing this manuscript: the Factoriza UAS platform, for data management and for descriptive and internal consistency analyses; a Python analysis program with fixed, validated procedures, for the omega coefficient, exploratory factor analysis and the correlations between dimensions; and the Claude Opus language model (Anthropic), for running that program, assisted literature searching, writing a draft and assembling the document from the results. The authors reviewed, corrected and approved the entire text, verified every reference and take full responsibility for the content of the article.

RESULTS

DESCRIPTION OF RESPONSES

Table 3 and Figure 1 present the descriptive statistics for the fifteen items. The Appreciation of *M*ining Heritage dimension had the highest means in the instrument: pride in Concordia's mining past (R7: M = 4.10, *SD* = 1.37), with 60% of responses at the maximum value and an asymmetric distribution concentrated toward the high values (skewness = -1.52); the preservation of the mining buildings (R6: *M* = 3.80, *SD* = 1.32); and the role of mining heritage in Concordia's identity (R10: *M* = 3.70, *SD* = 1.42).

The recoded item on mining remains had a mean of 3.50 and the lowest dispersion in the instrument (R8: *SD* = 0.97), and the desire for visitors to learn about mining history had the lowest mean in the dimension (R9: *M* = 3.10, *SD* = 1.45).

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In the Shared Memory of Mining dimension, the means were close to the midpoint of the scale, ranging from the item on mining stories told within the family (R1: *M* = 3.40, *SD* = 1.58) to the item on recognition of mining as part of the community's history (R2: *M* = 3.00, *SD* = 1.49). Knowledge of places linked to mining showed the greatest dispersion in the instrument (R5: *M* = 3.20, *SD* = 1.81), with 30% of responses at the minimum value and 40% at the maximum. The shared memory of the mining era had an equally polarized distribution (R3: *M* = 3.10, *SD* = 1.73).

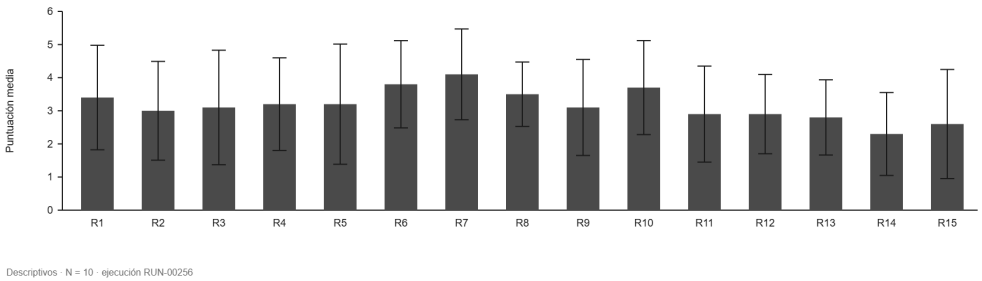
Living conditions in Concordia contained the lowest means. The desire to move to another city, in its recoded version, had the lowest mean on the instrument (R14: *M* = 2.30, *SD* = 1.25), indicating that responses leaned toward agreement with that desire. It was followed by street safety (R15: *M* = 2.60, *SD* = 1.65), with 40% of responses at the minimum value, job opportunities (R13: *M* = 2.80, *SD* = 1.14), and enjoyment of living in Concordia and the availability of what is needed for daily life (R11 and R12: *M* = 2.90).

Table 3. Descriptive statistics of the items.

Item	M	SD	Skewness	Kurtosis	Floor	Ceiling
R1	3.40	1.58	-0.62	-1.16	20%	30%
R2	3.00	1.49	0.00	-1.33	20%	20%
R3	3.10	1.73	-0.19	-1.89	30%	30%
R4	3.20	1.40	0.17	-0.97	10%	30%
R5	3.20	1.81	-0.23	-2.02	30%	40%
R6	3.80	1.32	-1.37	1.34	10%	30%
R7	4.10	1.37	-1.52	1.80	10%	60%
R8	3.50	0.97	0.45	-0.52	10%	20%
R9	3.10	1.45	-0.21	-0.99	20%	20%
R10	3.70	1.42	-0.80	-0.38	10%	40%
R11	2.90	1.45	-0.33	-1.22	30%	10%
R12	2.90	1.20	-0.74	-0.88	20%	40%
R13	2.80	1.14	0.48	0.55	10%	10%
R14	2.30	1.25	0.99	1.21	30%	10%
R15	2.60	1.65	0.43	-1.47	40%	20%

Note.N = 10. R1 to R5 = Shared memory of mining; R6 to R10 = Appreciation of mining heritage; R11 to R15 = Living conditions in Concordia. Reverse-scored items R4, R8 and R14 are shown recoded, so that a high value always indicates a favorable position. Floor and ceiling indicate the percentage of responses at the minimum and maximum values. The item–total correlation column from the Factoriza descriptive table is omitted; its values do not match those in Table 4 because they are not calculated from the total of each dimension. Factoriza UAS run RUN-00256. Preliminary cutoff: n = 10 out of a target of 100, with data collection still open.

Figure 1. Mean item scores with one-standard-deviation bars.



ITEM ANALYSIS AND INTERNAL CONSISTENCY

Table 4 presents the item analysis for each dimension. For Shared Memory of Mining, alpha was .462.

Recognition of mining as part of the community's history (R2: .742), knowledge of places linked to mining (R5: .605), and family histories (R1: .498) had the highest corrected item-total correlations; shared recollection of the mining era had a low correlation (R3: .279), and the recoded item on forgetting mining history had a negative correlation (R4: -.573).

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Removing R4 would raise the alpha to .789.

For Appreciation of Mining Heritage, alpha was .713. The role of heritage in Concordia's identity (R10: .902), pride in the mining past (R7: .871), and the conservation of mining buildings (R6: .796) had high corrected item-total correlations; the desire for visitors to learn about mining history had a moderate correlation (R9: .437).

The recoded item on the remnants of mining had a negative correlation (R8: -.481), and its deletion would raise alpha to .901.

For Living Conditions in Concordia, alpha was .542. Enjoying living in Concordia (R11: .795), the availability of what is needed for daily life (R12: .677), and safety on the streets (R15: .499) showed the highest correlations; job opportunities had a near-zero correlation (R13: .089), and the recoded item on the desire to move to another city had a negative one (R14: -.289). Removing R14 would raise alpha to .760.

Table 4. Item analysis by dimension.

Dimension	Item	Corrected item-total r	α if item deleted
Memory	R1	.498	.218
Memory	R2	.742	.032
Memory	R3	.279	.382
Memory	R4	-.573	.789
Memory	R5	.605	.075
Assessment	R6	.796	.521
Assessment	R7	.871	.475
Assessment	R8	-.481	.901
Assessment	R9	.437	.682
Assessment	R10	.902	.451
Living conditions	R11	.795	.105
Living conditions	R12	.677	.269
Living conditions	R13	.089	.590
Living conditions	R14	-.289	.760
Living conditions	R15	.499	.336

Note.N = 10. Scale from 1 to 5; reverse-scored items R4, R8, and R14 are shown recoded. Factoriza UAS run RUN-00256. Preliminary data cut: n = 10 out of a target of 100, with data collection still open.

Table 5 presents the internal consistency estimated by the complementary analysis program. The alpha values match those obtained with Factoriza (.462, .713, and .542).

Omega is not reported for any of the three dimensions because, in each one, the reverse-scored item correlates negatively with the rest, and under these conditions the coefficient is not interpretable. The program warns that this situation signals a problem in the instrument's definition when the item is not flagged as reverse-scored; in this case, all three items are indeed flagged and recoded, so their negative correlation indicates that, once recoded, they still vary in the opposite direction to the other items in their dimension.

Table 5. Internal consistency by dimension.

Dimension	Items	n	α	ω
Memory	5	10	.462	
Assessment	5	10	.713	
Living conditions	5	10	.542	

Note.N = 10. Memory = Shared memory of mining; Valuation = Valuation of mining heritage; Living conditions = Living conditions in Concordia. The corrected item-total correlation excludes the item itself from the total of its dimension. Cronbach's α for each full dimension (5 items each): Memory = .462 (run RUN-00257); Valuation = .713 (RUN-00259); Living conditions = .542 (RUN-00261). Source: Factoriza UAS, Tables 4, 6, and 8 of the package, compiled without modifying values. Preliminary data cut: n = 10 of a target of 100, with data collection still open.

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INTERNAL STRUCTURE

The exploratory factor analysis could not be interpreted. With 10 cases for 15 items (0.7 cases per item), the correlation matrix was not of full rank, the Kaiser-Meyer-Olkin measure and Bartlett's test could not be computed, and the software warned that the factor results are unstable with that sample size.

For this reason, the loadings, communalities, and explained variance are not reported; they are retained in the reproducibility appendix. The software's item flags (insufficient loading, cross-loading, or opposite sign) derive from that solution and are not interpreted as evidence about the structure of the scale. The internal structure will need to be examined with the final data cut.

CORRELATIONS BETWEEN ITEMS

Table 6 presents the Pearson correlations between the items of each dimension. In the Shared memory of mining dimension, recognition of mining as part of the community's history was strongly related to knowledge of places linked to mining (R2 and R5: r = .822, 95% CI [.399, .957], p = .004), and family stories were related to that same knowledge (R1 and R5: r = .668, 95% CI [.066, .913], p = .035).

The recoded item on forgetting mining history was negatively related to knowledge of places (R4 and R5: r = -.675, 95% CI [-.915, -.078], p = .032) and, with an interval that included zero, to recognition of mining in community history (R2 and R4: r = -.533, 95% CI [-.870, .145], p = .113).

In Valuation of Mining Heritage, pride in the mining past was very strongly related to the conservation of buildings (R6 and R7: r = .875, 95% CI [.545, .970], p < .001) and to the role of heritage in Concordia's identity (R7 and R10: r = .875, 95% CI [.546, .970], p < .001). The latter two aspects were related to each other (R6 and R10: r = .797, 95% CI [.337, .950], p = .006). The recoded item on the remains of mining was negatively related to the desire for visitors to learn about the mining history (R8 and R9: r = -.671, 95% CI [-.914, -.071], p = .034).

In Living Conditions in Concordia, enjoyment of living in Concordia was related to the availability of daily necessities (R11 and R12: r = .826, 95% CI [.410, .958], p = .003) and to street safety (R11 and R15: r = .633, 95% CI [.006, .903], p = .049). By contrast, the recoded item on the desire to leave was not related to enjoyment of living in Concordia (R11 and R14: r = .018) and was negatively related to job opportunities, with an interval that included zero (R13 and R14: r = -.422, 95% CI [-.831, .282], p = .224). With 10 cases, all intervals are wide.

Table 6. Correlations between items within each dimension.

Dimension	Variable pair	r	IC 95%	p
Memory	R1 and R2	.472	[-.224, .849]	.168
Memory	R1 and R3	.065	[-.589, .667]	.858
Memory	R1 and R4	-.191	[-.733, .498]	.596
Memory	R1 and R5	.668	[.066, .913]	.035
Memory	R2 and R3	.560	[-.107, .880]	.092
Memory	R2 and R4	-.533	[-.870, .145]	.113
Memory	R2 and R5	.822	[.399, .957]	.004
Memory	R3 and R4	-.377	[-.813, .331]	.283
Memory	R3 and R5	.347	[-.361, .802]	.325
Memory	R4 and R5	-.675	[-.915, -.078]	.032
Assessment	R6 and R7	.875	[.545, .970]	< .001
Appraisal	R6 and R8	-.347	[-.802, .361]	.325
Assessment	R6 and R9	.478	[-.217, .851]	.163
Assessment	R6 and R10	.797	[.337, .950]	.006
Assessment	R7 and R8	-.375	[-.813, .333]	.285
Assessment	R7 and R9	.554	[-.116, .878]	.097
Assessment	R7 and R10	.875	[.546, .970]	< .001
Assessment	R8 and R9	-.671	[-.914, -.071]	.034
Assessment	R8 and R10	-.282	[-.774, .423]	.430
Assessment	R9 and R10	.611	[-.030, .896]	.061

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Dimension	Variable pair	r	IC 95%	p
Living conditions	R11 and R12	.826	[.410, .958]	.003
Living conditions	R11 and R13	.122	[-.550, .698]	.738
Living conditions	R11 and R14	.018	[-.618, .641]	.960
Living conditions	R11 and R15	.633	[.006, .903]	.049
Living conditions	R12 and R13	.229	[-.468, .750]	.525
Living conditions	R12 and R14	-.200	[-.737, .491]	.579
Living conditions	R12 and R15	.541	[-.134, .873]	.106
Living conditions	R13 and R14	-.422	[-.831, .282]	.224
Living conditions	R13 and R15	.250	[-.451, .760]	.487
Living conditions	R14 and R15	-.313	[-.787, .395]	.379

Note.α = Cronbach's alpha; ω = McDonald's omega total, estimated from a one-factor minimum-residual model without reversing items. Complete cases per dimension. Source: Prepared by the authors using analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0046_FZ_HAB_0022. Memory = Shared memory of mining; Appreciation = Appreciation of mining heritage; Living conditions = Living conditions in Concordia. Program observations, transferred to this note: Memory: Items in the opposite direction: R4; ω not interpretable; Appreciation: Items in the opposite direction: R8; ω not interpretable; Living conditions: Items in the opposite direction: R14; ω not interpretable. The three flagged items are the reverse-worded items, already recoded in the matrix. The α matches that obtained with Factoriza. Preliminary cutoff: n = 10 out of a target of 100, with data collection still ongoing.

RELATIONSHIPS BETWEEN DIMENSIONS

Table 7 presents the Spearman correlations between the mean scores of the three dimensions. Shared memory of mining and Valuation of mining heritage were positively related, with a moderate-to-strong magnitude and an interval that included zero (ρ = .617, 95% CI [-.087, .910], *p* = .057). The correlations of Living conditions in Concordia with memory (ρ = .253, 95% CI [-.457, .766], *p* = .480) and with heritage valuation (ρ = -.264, 95% CI [-.771, .449], *p* = .461) were weak and of opposite sign, with very wide intervals. The mean scores include the reverse-scored items, whose divergent behavior was described above; this should be kept in mind when interpreting these correlations.

Table 7. Correlations between dimensions.

Dimension pair	n	ρ	IC 95 %	p
Memory and Appraisal	10	.617	[-.087, .910]	.057
Memory and Living conditions	10	.253	[-.457, .766]	.480
Assessment and Living conditions	10	-.264	[-.771, .449]	.461

Note.N = 10. Memory = Shared memory of mining; Appreciation = Appreciation of mining heritage; Living conditions = Living conditions in Concordia. Pearson correlation; 95% confidence intervals based on Fisher's z transformation. Cross-sectional design: relationships are associations. Source: Factoriza UAS, Tables 5, 7, and 9 of the package (runs RUN-00258, RUN-00260, and RUN-00262), combined without modifying values. Preliminary data cut: n = 10 of a target of 100, with the survey still open.

DISCUSSION OF RESULTS

This study examined the preliminary psychometric properties of a scale of mining memory, heritage and livability using a data cut of 10 cases in Concordia, Sinaloa. The first finding is descriptive: respondents rated mining heritage more favorably than their memory of mining and, above all, than their current living conditions.

Pride in the mining past was the most highly rated aspect of the instrument, whereas the desire to move to another city, street safety and job opportunities received the least favorable ratings. This contrast between a valued past and a present viewed with reservations is consistent with the literature describing how post-mining communities construct their identity around a shared past (Walker, 2021) and with work cautioning that place attachment in mining territories coexists with uncertainty about living conditions (Krüger et al., 2022; Qing et al., 2022).

The second finding, and the most relevant one for the instrument, concerns the reverse-worded items. In all three dimensions, the reverse-worded item correlated negatively with the remaining items after recoding, which precluded the estimation of omega and lowered alpha. This common pattern is open to two interpretations that the current cross-sectional design does

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not allow us to disentangle. The first is a wording-related bias, documented in scales that combine positively and negatively worded items, in which some respondents answer both types of items inconsistently (García-Batista et al., 2021; Steinmann et al., 2022).

The second is substantive: the reverse-worded items might capture content other than what they are intended to reverse.

The substantive interpretation is supported by the pattern of correlations. Those who knew more mining-related sites agreed most strongly that the mining history of Concordia is being forgotten. R4 therefore appears to capture awareness of a loss, which is greater precisely among those who preserve the memory, rather than an absence of memory. Similarly, those who most wanted visitors to learn about the mining history were the ones who most strongly agreed that the remains of mining make the town unsightly.

This result is consistent with the distinction between a valued intangible heritage and a tangible heritage perceived as a burden (Bockelmann, 2023), and suggests that the valuation dimension brings together two distinct objects: mining history and identity, on the one hand, and the material remains, on the other.

In Living Conditions, the desire to leave was not related to enjoyment of living in Concordia, which indicates that the intention to move away may reflect practical, and not only affective, reasons, as the literature on attachment and relocation suggests (Qing et al., 2022).

The third finding concerns the structure of the dimensions. The direct items of Valuation of Mining Heritage showed very high intercorrelations, ranging from .797 to .875 among pride, conservation and identity. This pattern indicates a homogeneous dimension centered on appreciation of the mining past, with possible redundancy among some of its items. In Shared Memory of Mining, the shared recollection of the mining era made a low contribution, and in Living Conditions, job opportunities made a near-zero contribution. Both items may refer to collective or structural content that is not evaluated from personal experience in the same way as the other items, consistent with the heterogeneity of the components of place attachment described in the literature (Boley et al., 2021; Xiang et al., 2022).

The fourth finding concerns the relationships between dimensions. Shared memory of mining and the valuation of mining heritage were positively related, with an interval that did not exclude zero, whereas living conditions showed no clear relationship with either. If this pattern is confirmed with the final data cut, it would indicate that appreciation of the mining past and evaluation of present life in Concordia are relatively independent, as observed in other mining territories where affective attitudes toward heritage do not correspond to cognitive and behavioral evaluations (Porras Bueno et al., 2024).

In terms of habitability, this independence suggests that mining heritage can be a resource for identity without, by itself, translating into a better evaluation of living conditions. This is consistent with the experience of Cerro de San Pedro (Arista Castillo and Barrera Fernández, 2022) and with the need for participatory processes that link heritage to the needs of residents (Ordaz Bulos and Sánchez Fonseca, 2024).

The results suggest several adjustments for the next stage. For the instrument, it would be advisable to revise the wording of the three reverse-worded items or rephrase them as directly worded items; to distinguish, within the valuation dimension, the items referring to history and identity from those referring to material remains; and to review the possible redundancy of the pride, conservation and identity items. For the procedure, it would be necessary to bring the sample up to the planned target; to document participants' characteristics, such as their family or occupational ties to mining and their years of residence; and to examine the internal structure using exploratory factor analysis and, with an independent sample, confirmatory factor analysis.

CONCLUSIONS

The study examined the preliminary psychometric properties of a fifteen-item scale on the shared memory of mining, the valuation of mining heritage, and living conditions in Concordia, Sinaloa, based on a preliminary data cut of 10 cases out of a target of 100. Respondents rated mining heritage favorably, particularly pride in the mining past, and rated their current living conditions less favorably.

Internal consistency was acceptable for Valuation of mining heritage (α = .713) and low for Shared memory of mining (α = .462) and Living conditions in Concordia (α = .542); omega was not interpretable for any dimension because the three reverse-scored items correlated negatively with the rest of their dimension. The exploratory factor analysis was not interpretable with this

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sample size.

The study has limitations that should be kept in mind when reading all of its results. The first concerns the size and nature of the data cut: 10 cases out of a target of 100, with data collection still open, are insufficient to estimate internal consistency and correlations precisely, and the correlation matrix is not of full rank, which prevented analysis of the internal structure. The second concerns the sample: the localities, the contact procedure, the type of sampling, and the characteristics of the participants have yet to be documented, and the results cannot be generalized.

The third concerns the instrument: the behavior of the reverse-keyed items must be reviewed, as it may reflect a wording bias or content other than that intended, and the recoding of these items must be verified. The fourth is analytical: the floor and ceiling percentages from Factoriza must be checked, and no confirmatory factor analysis was performed. The fifth relates to the design: because the study is cross-sectional, it does not allow causal inferences.

Directions for future work follow from these limitations. Once the final data cutoff is available, it will be advisable to repeat the item analysis and the omega estimation, run the exploratory factor analysis, and examine whether heritage valuation is organized into facets related to history and to material remains.

With an independent sample, confirmatory factor analysis would make it possible to test the structure obtained. The relationship between the dimensions and variables such as years of residence, family ties to mining, or the intention to remain in Concordia would provide validity evidence based on relations to other variables. This information would be useful for heritage and livability policies in the mountain towns of southern Sinaloa, where the mining past appears as a resource for identity that coexists with a guarded assessment of living conditions.

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