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Design and Validation of an Instrument to Measure Knowledge about Gender Identity and Sexual Orientation in Chilean Higher Education Students

Design and Validation of an Instrument to Measure Knowledge about Gender Identity and Sexual Orientation in Chilean Higher Education Students

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Abstract

Knowledge of gender identity and sexual orientation is essential to build more inclusive, equitable and respectful societies, where each person can live authentically without facing discrimination or stigmatization. The research focused on designing and validating an instrument to measure knowledge of gender identity and sexual orientation in Chilean higher education students. For this task, rigorous criteria were followed in the design and validation process: theoretical review, expert judgment, cognitive interview, and exploratory and confirmatory factor analysis. The instrument was administered to a convenience sample of 401 students belonging to a higher education institution located in the Biobío region, Chile. The results revealed a latent structure with adequate fit to the data, composed of 15 items underlying the variables of gender identity and sexual orientation. Reliability was established at an Omega coefficient of .87 and a Cronbach's alpha of .86, indicating satisfactory internal consistency. The instrument is a tool that seeks to promote inclusion, equity and understanding, by identifying areas of ignorance or misunderstandings that could contribute to discriminatory attitudes or unintentional exclusions

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in the context of higher education. It also provides information for the design of future educational programs that promote inclusion, equity, and understanding.

Keywords: Higher education; gender identity; sexual orientation; validation.

Resumen

El conocimiento hacia la identidad de género y la orientación sexual es esencial para construir sociedades más inclusivas, equitativas y respetuosas, donde cada persona pueda vivir auténticamente sin enfrentar discriminación o estigmatización. La investigación se enfocó en diseñar y validar un instrumento para medir el conocimiento hacia la identidad de género y la orientación sexual en estudiantes chilenos de educación superior. Para este cometido, se siguieron criterios rigurosos en el proceso de diseño y validación: revisión teórica, juicio de expertos, entrevista cognitiva y análisis factoriales exploratorio y confirmatorio. El instrumento se administró a una muestra por conveniencia de 401 estudiantes pertenecientes a una institución de educación superior ubicada en la región del Biobío, Chile. Los resultados revelaron una estructura latente con adecuado ajuste para los datos, compuesta por 15 ítems que subyacen a las variables de identidad de género y orientación sexual. La fiabilidad se estableció en un coeficiente Omega de .87 y un alfa de Cronbach de .86, indicando una consistencia interna satisfactoria. El instrumento es una herramienta que busca promover la inclusión, la equidad y la comprensión, al identificar áreas de desconocimiento o malentendidos que podrían contribuir a actitudes discriminatorias o exclusiones involuntarias en el contexto de la educación superior. Asimismo, proporciona información para el diseño de futuros programas educativos que promuevan la aceptación de las diferencias.

Palabras clave: Educación superior; identidad de género; orientación sexual; validación.

Introduction

The movements of the lesbian, gay, trans, bisexual, intersex, queer and other (LGTBIQ+) communities have achieved important advances in socio-educational inclusion, especially in the recognition of gender identity and sexual orientation (Latin American Open Data Initiative, 2021). Gender identity is defined as the internal process of identification that a person experiences, expressing being a girl, woman, boy, man or an alternative gender that may or may not correspond to the sex assigned at birth. This self-concept has a considerable impact on educational settings (Lindqvist et al., 2021). Sexual orientation is made up of different components such as sexual behaviour, fantasies, and sexual and emotional attraction to another person. This attraction is experienced in a unique way (Nebot et al., 2020).

In 2006, the Yogyakarta Principles (2017) on the implementation of international human rights law in relation to sexual orientation and gender identity were established. Since their inception, some States have made progress in enacting legislation to guarantee equality rights and arbitrary non-discrimination. However, large-scale research and

literature highlight persistent human rights violations, including denial of employment, child abuse, sexual assault, hate crimes and limited opportunities to access education (Lee et al., 2021; Markland et al., 2023; Martínez et al., 2022; Valderrábano et al., 2021; Veras et al., 2022).

In recent years, there has also been an increase in regulations restricting the rights of LGTBIQ+ people, due to the rise of extreme right-wing political groups and religious positions that introduce exclusionary dynamics (Veldhuis, 2022). Marginalisation has harmful consequences that affect their health and social well-being, even leading to suicidal situations. Worldwide data suggest that suicide rates among people belonging to gender minorities amount to 41%, a worrying figure compared to the 4.6% risk for non-minorities (Veras et al., 2022).

According to González (2022), in Latin America and the Caribbean, it is a cause for concern that, out of 51 countries studied, 9 still maintain bans on same-sex relationships, punishing them with sentences ranging from 2 years to life imprisonment. With regard to same-sex marriage, only 17 countries allow it, a figure similar to that for adoption. This report shows how human rights face various political, social, economic and cultural barriers. According to Amnesty International (2023), in this sense, comparisons inevitably arise, highlighting countries such as Uruguay that offer protection to the LGTBIQ+ collective, while in others, such as Paraguay, these protections are practically non-existent. In addition, , in the context of Paraguay, a bill was recently presented to prohibit the promotion and teaching of gender ideology in educational environments.

In the context of the research interest, Chile, as a signatory to several international covenants, has enacted various regulations that have paved the way for protecting the rights of the LGTBIQ+ community. For example, Law No. 21.400/2021 which regulates same-sex marriage, and Law No. 21.120/2018 which recognises and provides protection for the right to gender identity. In this regard, individuals can rectify their birth certificate in terms of name and sex.

In the field of education, Chile has also made progress in regulations aimed at eradicating all types of abuse. For example, Law No. 21.369/2021 which regulates sexual harassment, violence and gender discrimination in higher education , and Law No. 20.536/2011 which seeks to promote good coexistence and prevent physical or psychological violence in school education. However, recent reports indicate that, despite legislative advances, challenges persist in their effective implementation. According to the Movimiento de Integración y Liberación Homosexual (2022), hate crimes have doubled compared to previous measurements. Specifically, the aforementioned study indicates that 1,046 outrages against the human rights of homosexuals have been registered, of which 52 correspond to educational discrimination, with a 333% increase in the number of cases in the educational system.

Despite expressions of legal support, the reality of this community has not undergone significant changes, as it is not "strange that there is no single sexuality plan, but rather that each establishment can provide the sexuality education it wishes or even

omit it" (Cornejo, 2018, p.3). Lack of knowledge on the subject is another result that contributes to the exclusion and discrimination of these groups. This lack of training fosters a hegemonic and exclusionary educational environment (Fernández et al., 2020; Galaz et al., 2021; Rubio-Aguilar et al., 2021). A thorough and accurate understanding of gender identity and sexual orientation knowledge among higher education students is essential for the development of inclusive and respectful educational environments (Sánchez et al., 2023).

In the literature, there are studies focused on the development and validation of instruments linked to the issue. For example, in the context of higher education in Spain, López-Sáez et al. (2023) adapted the Attitudes Towards Trans Men and Trans Women (ATTMW) Scale (Billard, 2018) with the aim of identifying transphobic attitudes and concluded that negative attitudes represent active manifestations that support a biologicist and essentialist perspective of what it means to be a man or a woman. The adaptation process followed phases such as translation, content validity with experts in gender psychology and psychometrics, and factor analysis. The instrument has a reliability of .93 according to the Omega coefficient

Sánchez-Hernández et al. (2020) designed and validated an instrument to measure Sexual Knowledge, Attitudes and Practices (CAPSEX). The process followed phases such as content validity and factor analysis. The internal consistency is .83 according to Cronbach's alpha. These authors conclude that sexuality education influences the development of attitudes and behaviours that contribute to the development of responsible sexuality. In another study, Verdejo-Muñoz (2020) designed a scale to measure knowledge and attitudes towards sexual and gender diversity in Spanish university students. The *ad hoc* instrument has a Cronbach's alpha reliability of .71 for the knowledge scale and .75 for the attitude scale. These authors conclude that it is imperative to deepen the knowledge of these topics in the university population, as it shows low levels of knowledge.

It is also possible to find instruments in the Argentinean context. Páez et al. (2015), developed and validated the Scale of Negative Attitudes towards Trans People (EANT) from which they found a unidimensional structure and negative and moderate relationships between attitudes and religious practice. Factor analyses were carried out in the process. Reliability is .88 according to Cronbach's alpha

In the Chilean context, Maureira et al. (2022) validated two scales that measure negative attitudes towards homosexuality (EHF-10) (Moral de la Rubia and Ortega, 2008) and transgender people (EANT) (Páez et al., 2015) in physical education students. The process included a pilot test and factor analyses. Both instruments demonstrated adequate internal consistency of .76 for EHF-10 and .90 for EANT. The results revealed low levels of homophobia and transphobia, with no significant differences between males and females.

In another study, Maureira et al. (2023) examined the psychometric properties of the Ambivalent Sexism Inventory (Glick and Fiske, 1996) in a sample of Chilean physical

education students. The aim was to study differences in sexism according to gender and year of study. The process included a pilot test and factor analyses. Regarding internal consistency, a Cronbach's alpha of .90 was found. These authors concluded that the availability of valid and reliable instruments makes it possible to identify sexist characteristics and reduce stereotypes associated with the practice of physical activity and sport, fostering more inclusive and equitable environments.

The above background reveals that, so far, there has not been adequate attention paid to students' knowledge of gender identity and sexual orientation. This training is presented as a preventive measure against discrimination, while promoting an atmosphere of respect and understanding among students, thus contributing to the development of inclusive educational environments (Zhang, 2023). A challenge identified is the lack of specific and validated instruments to measure this knowledge in the national context, as most focus on measuring negative attitudes towards LGTBIQ+ students. Yáñez-Urbina et al. (2022) highlight the need for a comprehensive and contextualised assessment of such knowledge. Therefore, this research seeks to design and validate an instrument to measure knowledge towards gender identity and sexual orientation in Chilean higher education students.

Method

Research design

The research is quantitative and adopts an instrumental design, characterised by analysing the psychometric properties of instruments, whether new tests or the translation and adaptation of existing tests (Ato et al., 2013). For the design and validation of the instrument, rigorous international criteria were followed, such as: theoretical review, expert judgments, cognitive interview and factor analysis (American Educational Research Association, American Psychological Association and National Council on Measurement in Education, 2018).

Participants

The sample for the validation of the instrument consisted of 401 students belonging to a higher education institution located in the Biobío region of Chile. The population of Biobío is heterogeneous, corresponding to a mix of people of indigenous, mestizo and European descent. The Institution has a Catholic identity and operates in the south-central part of the country, offering academic courses in the areas of science, economics, theology, engineering, social sciences and medicine.

Table 1 presents the socio-demographic characteristics of participants selected by non-probability purposive sampling.

Table 1

Characteristics of the sample

	Variables	n	%
Gender	Cisgender	353	88%
	Fluid gender	4	1%
	Non-binary	4	1%
	Genre	2	.5%
	I prefer not to say	38	9.5%
Sexual orientation	Straight	275	68.6%
	Bisexual	92	22.9%
	Homosexual	14	3.5%
	Demisexual	8	2%
	Asexual	2	.5%
	Pansexual	1	.2%
	I prefer not to say	9	2.2%
Age	17 to 21 years old	291	72.5%
	22 to 26 years old	100	24.9%
	27 to 30 years old	7	1.7%
	> to 31 years	3	.7%
Disciplinary area	Medicine	99	24.6%
	Education	94	23.4%
	Engineering	79	19.7%
	Social sciences	70	17.5%
	Economic sciences	38	9.5%
	Science	15	3.7%
	Humanities	5	1.2%
	Legal sciences	1	.2%

In relation to sample size, the classical recommendation of at least 200 cases was considered for conducting factor analyses (Lloret-Segura et al., 2014). Therefore, a subsample of 200 participants was used to explore the underlying structure using Exploratory Factor Analysis (EFA). Then, to confirm this structure, a sub-sample of 201 participants was used, this time using Confirmatory Factor Analysis (CFA).

The instrument was administered using a Google form, and QR codes were placed in the faculties of the university campus for dissemination. The students voluntarily expressed their intention to participate in the research through a previous section of the form, where the principles of anonymity, confidentiality and scientific treatment of the data provided were highlighted.

Design of the instrument

Theoretical review: The initial version of the instrument was based on the questionnaire of knowledge and attitude towards sexual and gender diversity developed

by (Verdejo-Muñoz, 2020). However, the construction and refinement of the items was based on the theoretical contributions of authors such as Lindqvist et al. (2021) and Nebot et al. (2020). The aforementioned individuals provide clear approaches to gender identity and sexual orientation. Integrating these theoretical concepts into the construction of the instrument ensured that the items were conceptually sound and supported by existing literature. The Verdejo-Muñoz (2020) questionnaire measures the level of knowledge and attitude of Spanish university students, and was designed following the phases: literature review, classification of items into dimensions, and validation by three expert judges.

The instrument consists of 32 items related to the *knowledge* dimension and 34 items belonging to the *attitude* dimension. It also includes a scale with three response options: true, false and don't know. The reliability, according to Cronbach's alpha, is .79 for the *knowledge* dimension and .75 for the *attitude* dimension.

Validation of the instrument

Process I. Validation by expert judgement : For this phase, the Content Validity Coefficient (CVC) proposed by Hernández-Nieto (2002) was followed, which allows the degree of agreement of the experts to be assessed. Likewise, this author recommends the participation of between three to five experts and the retention of those items with a CVC above .80. This evaluation is carried out through the consultation of five expert judges. Table 2 presents the main characteristics that support the suitability of their participation.

Table 2

Characteristics of judges

ID	Sex	Nationality	Academic degree	Lines of research	Years of experience
1	Woman	Spanish	PhD in Education	Sex education and gender identity	15
2	Woman	Chilena	PhD in Education	Sexual diversity and gender identity	29
3	Man	Spanish	Doctor of Education	Cultural, social and gender identities	18
4	Man	Chilena	PhD in Political Science	Educational Inclusion and Queer Pedagogy	30
5	Man	Chilena	PhD in Social and Cultural Anthropology	Diversity, gender and education	20

Each judge was sent, via email, a validation guideline for the initial version of the instrument. They were asked to critically analyse and evaluate each of the items in relation to categories of sufficiency, clarity, coherence and relevance, using a three-choice scale. They were also asked to point out possible aspects in the measurement of the

construct that had not been considered by the researchers. Some of the main ratings are described below :

Judge ID 1. In the sexual orientation dimension, he proposed to limit item 1 due to its length, as follows: *sexual orientation is exclusively determined by sexual and affective behaviours.* In addition, he suggested the deletion of items 2, 3 and 7, arguing their irrelevance to the dimension.

Judge ID 2. In the gender identity dimension, he proposed an alternative wording for item 5 as follows: *gender identity is the subjective perception that an individual has of him/herself in terms of his/her own gender, which may or may not coincide with the sex assigned at birth*. He also suggested deleting items 4 and 15, the former because it has an attribute such as success that is not linked to gender identity, and the latter because it is a judgement rather than a statement. In the sexual orientation dimension, he proposed starting the items by referring to people rather than orientation.

Judge ID 3. In the gender identity dimension, he proposed modifications to items 6, 8, 9, 10, 11 and 14 in order to improve understanding. In the sexual orientation dimension, he suggested the elimination of items 7, 9 and 11, arguing that the quantification of sexual orientation and its frequencies does not provide relevant information for its measurement as a construct.

Judge ID 4. In the sexual orientation dimension, he questioned the relevance of items 2, 3, 4, 5, 9 and 10, arguing that, instead of contributing to knowledge, they tend to fall into the opinionated. He therefore proposed the deletion of these items.

Judge ID 5. In the sexual orientation dimension, suggested the elimination of item 2 as it does not contribute to the construct.

Based on suggestions, indications and CVCs below .80, 8 items were removed. Table 3 details the new version of the instrument.

Table 3

Version of the instrument after validation by expert judges

Item	Content *(gender identity dimension)*
1	Sex assigned at birth determines gender (I)
2	Gender dysphoria is a mismatch between sexual and gender identity and the sex assigned at birth.
3	More cisgender men than cisgender women (I)
4	Gender identity is an individual's subjective perception of their own gender, which may or may not coincide with the sex assigned to them at birth.
5	Cisgender people are more likely to be bisexual than agender people (I)
6	Cisgender people are more likely than gender queer people to be heterosexual.
7	Gender fluid is possessed by those whose identity transcends the binary gender (male or female).
8	Transgender refers to any gender identity that transcends socially assigned gender.

9	Pangender people have a sense of belonging to all genders.
10	Gender can only be binary (masculine or feminine) (I)
11	Gender-neutral people are those who have the feeling that they do not belong to any gender.
12	Demigendering refers to the feeling of having multiple genders, some stationary and some fluid (I).
13	Transgender people are those whose gender identity does not correspond to their sex assigned at birth.
Item	**Content *(sexual orientation dimension)***
1	Sexual orientation is uniquely determined by sexual and affective behaviours (I)
2	Heterosexual people are more likely to identify as cisgender than homosexual people.
3	Bisexual people are non-assuming homosexual people (I)
4	Bisexuality is a sexual orientation on the same level as homosexuality or heterosexuality.
5	Human sexuality presents itself on a continuum from exclusively heterosexual to exclusively homosexual.
6	A person can have sexual relations with others of the same sex without necessarily being homosexual or bisexual.

Note: Reverse (I) items in the instrument

Process II. Cognitive interview validation: The cognitive interview allows obtaining evidence of validity in response processes. Following guidelines for the use and application of interviews by Caicedo and Zalazar-Jaime (2018), five interviews were conducted with students of nutrition, science, social work, engineering and pedagogy, in order to assess the clarity and understanding of the items. This process lasted 35 minutes and began with a greeting, the presentation of the research objective and indications about anonymity and confidentiality of the information. Subsequently, each participant was given the new version of the instrument with the statements and instructions on how to respond. The researcher used the think-aloud technique, asking the participant to verbalise their thoughts before extended pauses .

The cognitive interview showed adequate wording of the items. However, students repeatedly paused, as they found certain terms confusing, such as cisgender, dysphoria and agender, attributable to lack of knowledge. In this context, they asked for the answer option *I don't know* to be added. The response options were as follows: (1) Strongly disagree; (2) Strongly disagree; (3) Moderately disagree; (4) Moderately agree; (5) Strongly agree; (6) Strongly agree; and (7) Don't know.

Process III. Psychometric validation: First, the degree of adequacy of the data for Exploratory Factor Analysis (EFA) was assessed using two indicators: Bartlett's test, which tests the null hypothesis that the correlation matrix is an identity matrix. If the null hypothesis is rejected, it means that the variables are correlated with each other, and that EFA can be useful to identify the underlying factors that explain the variance; and the

Kaiser, Meyer and Olkin (KMO) measure, which indicates how large the correlation between the variables is. A value greater than or equal to .80 is considered satisfactory (Ferrando and Anguiano-Carrasco, 2010).

The Maximum Likelihood method was used to estimate the factors, as the items have 7 response options and the data distributions are approximately normal, with skewness and kurtosis values less than 2 (Flora et al., 2012). Regarding the number of factors to be retained, two measures were considered: Parallel Analysis, which selects common factors with eigenvalues greater than those that would be obtained by chance (Horn, 1965), and the sedimentation plot, which selects factors with eigenvalues greater than 1.

Next, oblique rotation was used for the factor rotation, as it assumes the existence of correlation between the variables under study. As for the criterion for assigning items to factors, saturations above .30 were retained (Bandalos and Finney, 2019). The items that did not exceed this value were revised in their theoretical and methodological aspects.

Secondly, to corroborate the above structure, Confirmatory Factor Analysis (CFA) was performed. The Maximum Likelihood method and global goodness-of-fit measures were used: Chi-square ($\chi 2$), root mean squared error of approximation (RMSEA), unstandardised fit index (TLI) and comparative fit index (CFI).

Thirdly, internal consistency was corroborated with Cronbach's alpha and Omega coefficient. The analyses were carried out in the Jamovi software version 2.3.

Results

Exploratory factor analysis

The results of Bartlett's test $\chi 2$ (171) = 1265, $p < .001$, rejected the null hypothesis that the correlation matrix is the identity. In addition, the KMO test yielded a satisfactory value of .87. Consequently, the data matrix is suitable for factorisation.

The Parallel Analysis indicated the existence of 3 factors, while the sedimentation plot suggested 2. In this sense, it was decided to retain 2 factors, which is also consistent with the theoretical proposal of the instrument.

Rotation results showed weak saturations for item 6 (below .30) of the *sexual orientation* factor. In addition, items 1 and 10 of the *gender identity* factor and item 4 of the *sexual orientation* factor did not correspond to the latent variables analysed. These items were deleted. Table 4 presents the distribution of factor solutions that explain 40.2% of the variance.

Table 4

Factorial solutions

Items	Gender Identity	Sexual orientation
11	.778	
9	.695	
13	.686	
7	.680	
12	.672	
4	.640	
6	.548	
2	.532	
3	.478	
8	.474	
5	.438	
3		.791
5		.727
1		.417
2		.403

Note: the Maximum Likelihood method was used in combination with an oblique rotation, oblimin

Confirmatory factor analysis

The results of the Chi-Square statistic indicate that the model does not fit the data ($\chi 2$ = 243, gl = 89, p = .001). However, due to its sensitivity to sample size it is suggested to consider other global goodness-of-fit measures (Ruíz et al., 2010). Table 5 presents complementary measures.

Table 5

Overall goodness-of-fit measures

Model	$\chi 2$	$\chi 2$/gl	IFC	TLI	RMSEA
2 factors	243	2.7	.84	.82	.09

Both CFI and TLI suggest that the model does not fit the data perfectly, as they are below the ideal value of 1. However, the results are not extremely low, which might indicate that the model has an acceptable fit (Ferrando and Anguiano-Carrasco, 2010). Figure 1 presents the diagram of the model together with the factor saturations. The *gender identity* factor consisted of 11 items with saturations between .50 and .74, while the sexual orientation factor consisted of 4 items with loadings between .44 and .76. Both constructs have a correlation of .44.

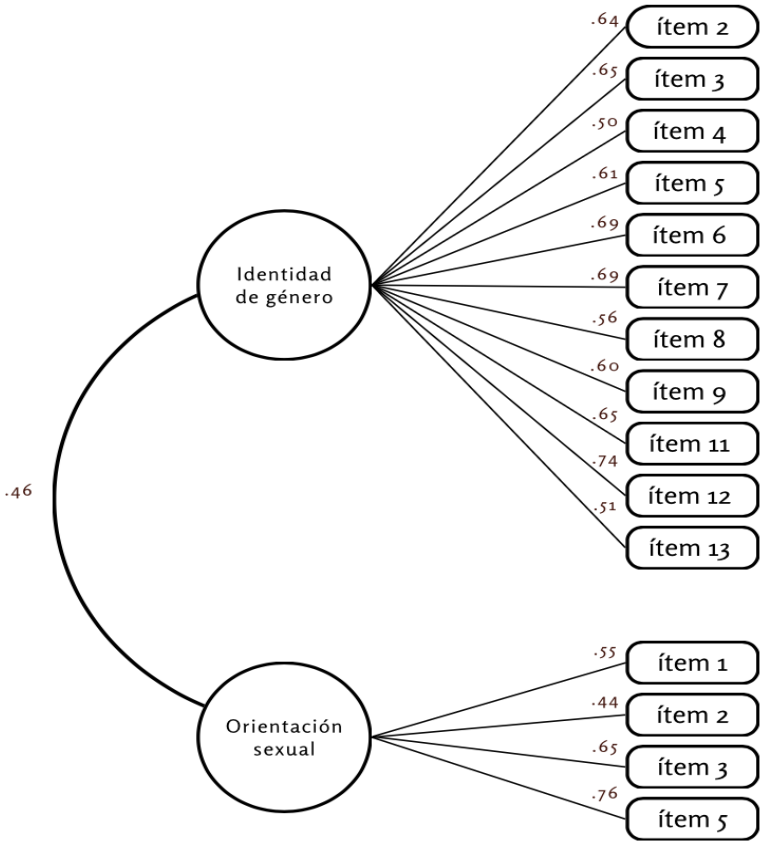

Figure 1. Diagram of the theoretical two-factor model

Reliability analysis

The resulting version of the AFC has an adequate internal consistency of .86 according to Cronbach's alpha and .87 according to the Omega coefficient (Ventura-León and Caycho-Rodríguez, 2017).

Discussion

The purpose of the research was to design and validate an instrument to measure knowledge of gender identity and sexual orientation in Chilean higher education students. The results supported the hypothesised theoretical model, so there is consistency with the literature consulted (Lindqvist et al., 2020; Nebot et al., 2020).

However, it is possible to establish comparisons with analysed instruments that measure the variables under study. With regard to the response options, the proposed instrument presents a 7-point Likert-type scale, including the option *I don't know*, which

is consistent with the Verdejo-Muñoz instrument (2020). The decision to opt for a 7-point scale is based on the variability that this range provides. The literature indicates that having a greater number of options allows the participant to accurately express their perceptions (Matas, 2018). This would be a difference with instruments analysed that tend to use 5-point scales (Martínez et al., 2022; Maureira et al., 2023).

In relation to the validity processes, the proposal demonstrates content validity, which was assessed by consulting five judges with active lines of research in the subject. This type of validity is observed in instruments analysed (López-Sáez et al., 2023; Sánchez-Hernández et al., 2020; Verdejo-Muñoz, 2020). However, they lack certain elements that we sought to highlight in the framework of this research, such as the specific characteristics of the judges, the evaluation method used and the key suggestions that were generated from their participation. Consequently, greater robustness and guarantees of future applicability in the higher education context are obtained.

In addition, the proposal exhibits response validity, which was evaluated through the application of cognitive interviews with five students from different careers. This allowed the identification and refinement of ambiguity in the items (Caicedo and Zalazar-Jaime, 2018). It is relevant to highlight that this type of validity has not been reported for the instruments analysed (Sánchez-Hernández et al., 2020; Verdejo-Muñoz, 2020). The incorporation of the direct perspective of the students contributed to improving the clarity and understanding of the items before administering the instrument to the study sample. This assessment is complemented by content validity provided by judges, who, while offering a valuable academic perspective, may be somewhat distant from students' practical experiences and understanding.

Regarding construct validity, the proposal was validated psychometrically following current recommendations in the literature (Lloret-Segura et al., 2014). This process involved exploratory and confirmatory factor analyses, ensuring an exhaustive evaluation of the underlying structure of the instrument. This supports Maureira et al. (2023) on the importance of having valid and reliable instruments that identify sexist aspects in education.

It is relevant to note that the design of the proposal involved extracting items from the Verdejo-Muñoz (2020) instrument, which presents a single dimension of knowledge and lacks construct validity. In contrast, the proposal corroborates the existence of two distinct dimensions: gender diversity and sexual orientation. This finding contributes to greater clarity and specificity in measurement.

Furthermore, the proposal differs from the instrument developed by Sánchez-Hernández et al. (2020) in the Spanish context, which identifies a single knowledge dimension composed of 8 items with factor saturations in the range .37 to .46. This instrument presents higher goodness-of-fit indicators compared to the proposal of this research. This opens the possibility of refining the proposal to capture more accurately the key aspects of this issue.

Regarding reliability, the proposal presents adequate internal consistency according to Cronbach's Omega and alpha coefficients. The latter estimator is widely reported in existing instruments on the subject (Maureira et al., 2022; Páez et al., 2015; Sánchez-Hernández et al., 2020). However, the literature argues that Cronbach's alpha is sensitive to the sample size, the number of items and the nature of the items. Its frequent use is also due to accessibility, as software such as SPSS does not implement it in its repertoire. Consequently, the proposal differs from instruments analysed because it is supported by a current recommendation to use Omega for a more accurate estimation of reliability when performing factor analyses (Ventura-León and Caycho-Rodríguez, 2017).

As evidenced in the previous phases of the work, through the literature review, there are few experiences focused on the evaluation of the level of knowledge about gender identity and sexual orientation among students. For the most part, the scales focus on the study of the attitudes of different educational agents towards LGTBIQ+ groups. In particular, in the case of the Latin American region, there are adaptations of international scales such as the one based on negative attitudes towards homosexuality (EHF-10) (Moral de la Rubia and Ortega, 2008). One of the most significant contributions that can be drawn from this work is that it provides the scientific community with an original proposal of items that is concerned with both quantitative and qualitative validity.

Conclusions

The research provides a valid and reliable instrument to measure knowledge towards gender identity and sexual orientation in Chilean higher education students. The literature consulted underlines that as people deepen their understanding of sex and gender minorities, a significant reduction in negative attitudes and arbitrary discrimination is observed. In this context, the instrument developed is positioned as a key tool to measure and, therefore, promote the growth of knowledge about these crucial issues, generating a positive impact on the perception towards the LGTBIQ+ collective.

The instrument has important implications. First, it contributes to evidence-based decision-making. Institutions can formulate inclusive policies to create more respectful educational environments for students, regardless of their gender identity or sexual orientation. Secondly, it serves as a tool for evaluating the effectiveness of intervention programmes, allowing strategies to be adjusted according to the results. Finally, it provides students with an opportunity to self-assess their own knowledge, which can lead to greater recognition of others and improve interpersonal relationships.

The instrument has some limitations that need to be considered in future research. First, the validity and reliability of the instrument are dependent on the cultural diversity and specific experiences of the study sample. Future research should consider cultural sensitivity to ensure that the items adequately reflect the realities of the population. Second, the measurement of knowledge through self-report instruments may be subject to bias. Some participants may underestimate or overestimate their knowledge for a variety of reasons, such as social pressure or perceptions of what is expected of them.

Future research may employ complementary techniques for data collection. It would be interesting to delve deeper into the discourses that students have about people with sexual and gender diversity through in-depth interviews, which would provide a more comprehensive view of the phenomenon. Therefore, a key factor is to advance in studies of a mixed nature.

Finally, although construct validity is presented through factor analysis, it is suggested to explore the relationship of the instrument with other measures that assess similar aspects to strengthen concurrent validity or different aspects to improve discriminant validity. Finally, gender identity and sexual orientation are dynamic constructs that may evolve over time. The instrument should be requested from the corresponding author, who will provide the corresponding format and how to obtain the score

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