frontiers in Education

ORIGINAL RESEARCH
published: 01 February 2022
doi: 10.3389/feduc.2021.773406

Factorial Invariance and Internal Structure of the Scale of the Students' Role in the Cycle of School Violence (ERECVE)

Juan C. Pérez-Morán and Juan C. Rodríguez-Macías*

Institute of Educational Research and Development, Autonomous University of Baja California, Ensenada, Mexico

The purpose of this study was to analyze evidence of construct validity of internal structure and factorial invariance for the Scale of the Students' Role in the Cycle of School Violence (ERECVE, in Spanish). To that end, we relied on a database of 13,389 participants with a sample of Mexican low secondary education students: 6,935 female and 6,454 male. Participants had a mean age of 13.08 years (SD = 0.98). The dimensionality and fit of a reconfigured five-factor model were analyzed using Confirmatory Factor Analysis (CFA); nested models sequencing methods were applied subsequently to validate invariance between genders. The results from the dimensionality analysis support the reconfigured five-factor structure for the dimensions referring to the roles of victim, defender or conciliator, sole bully, social bully and bystander. Moreover, acceptable fit indices were obtained for the *configurational, weak, strong* and *strict* models after comparing the nested models. It was concluded that the reconfigured five-factor model is useful for measuring the roles of students in the cycle of school violence, and that the ERECVE achieves a simultaneous measurement invariance, thereby favoring the analysis of mean differences between genders.

Keywords: measurement invariance, bullying, gender, Confirmatory factor analysis (CFA), low secondary education

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****Correspondence:***
Juan C. Pérez-Morán
juan.carlos.perez.moran86@uabc.edu.mx

Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *09 September 2021*
Accepted: *28 December 2021*
Published: *01 February 2022*

Citation:
Pérez-Morán JC and Rodríguez-Macías JC (2022) Factorial Invariance and Internal Structure of the Scale of the Students' Role in the Cycle of School Violence (ERECVE). Front. Educ. 6:773406. doi: 10.3389/feduc.2021.773406

INTRODUCTION

School violence is one of the major and most common concerns in basic education institutions around the world (Organization for Economic Co-operation and Development, 2017; United Nations Educational, Scientific and Cultural Organization, 2019). Violence encompasses situations of physical or psychological aggression and threats among students, teachers or school management personnel (Astor and Benbenishty, 2018). Among the different types of school violence, bullying has stood out particularly. Bullying is the systematic abuse of power among peers through the repetition of intentionally aggressive behaviors toward a specific person or group (Olweus, 1993 Menesini and Salmivalli, 2017). Bullying has major implications in the victims' lives beyond the social aspects at school (Salmivalli and Peets, 2018); in addition to the aggressions themselves, bullying victims are known to have significantly higher chances of developing: a) psychosomatic and adverse symptoms affecting their quality of life (Moore et al., 2017; Schoeler et al., 2018); b) suicidal behavior and ideation (Moore et al., 2017); c) mental disorders (Schoeler et al., 2018); and d) low academic performance compared to unaffected peers (Reijntjes et al., 2011; Caputo, 2014; Ttofi et al., 2016). One out of every three students worldwide is thought to experience bullying (United Nations Educational, Scientific and Cultural Organization, 2019), whereas men, in comparison to women, are

more prone to become victims or bullies (Organization for Economic Co-operation and Development, 2017; Smith et al., 2019). The Mexican outlook is similar to the rest of the world; it is estimated that one out of every five students in Mexico is a frequent victim of school bullying (Organization for Economic Co-operation and Development, 2017; Vega-Cauich, 2019).

Due to the severity of the school bullying problem, a wide variety of measurement instruments have been devised to obtain information for decision-making and intervention, each of them based on well-established theories and different measurement strategies (Vessey et al., 2014; Holt et al., 2015). One of the best-known theoretical standpoints for the study of bullying is the one proposed by Dan Olweus. (1993) regarding the main components of bullying: imbalance, the intention to do harm, the harm experienced by the victim, repetition and aggressive behaviors. In addition, he considers bullying to be a social phenomenon in which the bully and the victim are not the only roles, identifying other direct and indirect participants who become a part of the cycle of violence. Salmivalli et al. (1996) expanded Olweus' theory by proposing additional roles in the cycle of violence: bully, victim, bully's reinforcers, bully's collaborators, victim's defenders and outsiders. Bullies commit violent acts targeting a victim and are distinguished by their physical and social dominion; victims endure the aggression from the bully; the bully's reinforcers encourage the violent behavior exercised by the bully and incentivize its repetition in the future through praise, laughter or cheering; the bully's collaborators do not initiate the aggression, but will join underway; the victim's defenders attempt to stop the aggression and provide comfort and support for them; and outsiders do not interfere with the bullying situation (Salmivalli et al., 1996; Samivalli, 2010).

Because most students become involved in school bullying, it is vital to identify the roles taken during the process for the proper understanding of the issue, and for planning, deploying and assessing actions to eliminate violence. To this end, Olweus developed the *Olweus Bully/Victim Questionnaire* (OBVQ). This has been one of the most widely used instruments for the measurement of roles of violence (Smith et al., 2019) and it's been translated and validated for different populations (Smith et al., 2019; Gaete et al., 2021; Martín-Babarro et al., 2021). Salmivalli et al. (1996) developed the *Participant Role Questionnaire* (PRQ), a three-stage instrument that evaluates the role that each student takes during the bullying process. In the first stage, students are presented with 50 bullying situations where they must identify the role of each of their classmates and their own. The situations are divided into five dimensions that inquire about the behavioral tendencies for each role in school bullying. The second stage consists of identifying victims based on the students' own indications. Should a student be mentioned by ≥ 30% of their peers, they are deemed to take the role of a victim, regardless of the interpretation of results at the previous stage. Lastly, the third stage consists of a sociometric study in which the three most liked and the three least liked classmates are identified.

The PRQ has been adapted for its application in different countries (e.g., Crapanzano et al., 2011) and the use of various measurement strategies (e.g., Salmivalli et al., 1996; Sutton and Smith, 1999; Demaray et al., 2016). Although this is not the only instrument available to measure school bullying, it has led to the design and development of other instruments (e.g., Goossens et al., 2006; Demaray et al., 2016). Recent studies have highlighted the limitations of the PRQ for its large-scale application. Moreover, Demaray et al. (2016) point out that using the three-option PRQ scale makes students' responses rather limited; in addition, having students identify their classmates' roles may cause a problem for its interpretation in large-scale applications and, when applied as a self-report instrument, construct validity evidences become insufficient for its generalization and comparison across groups.

One of the most important metric properties for intergroup comparison is factorial invariance, which assesses the equivalence of a construct across groups and demonstrates that it has the same meaning for its constituent parties (Jöreskog and Sörbom, 1979; Byne et al., 1989). In particular, there is enough evidence to suggest that school bullying may not be conceptualized equally among different gender groups (Salmivalli et al., 1998; Crapanzano et al., 2011; Lucas-Molina et al., 2014; Feijóo et al., 2021). Few studies apply factorial invariance analyses on instruments measuring a number of roles in school bullying. Lucas-Molina et al. (2014) conducted a psychometric study of the Spanish adaptation of the Participant Role Approach (PRA) in which the factorial invariance across genders was analyzed (Sutton and Smith, 1999) in an elementary school population. Although the configurational model yielded an adequate fit, simultaneous measurement invariance was not achieved, which made fitness of mean differences between genders more difficult to attain. Similarly, Alcántar-Nieblas et al. (2018) conducted a metrics analysis on the Mexican adaptation of PRA (Sutton and Smith, 1999) and examined the factorial invariance between genders. Reported findings suggest that the Mexican adaptation of PRA shows evidence of configurational, metric, scale and strict invariance between men and women.

Despite the vast utility of these studies, some considerations should be highlighted. First, although both instruments (PRQ and PRA) study the various roles of students in terms of bullying, they neither align with nor represent all the roles involved in the bullying cycle, making it difficult to contrast them with interpretative frameworks that favor decision-making for intervening and designing educational policies that attempt to solve the problem in schools within the educational systems. For example, the study by Lucas-Molina et al. (2014) considers three factors only: bully-victim, defender and outsider; this indicates that, should a student relate strongly to one of the behaviors found within the first factor, it would be difficult to ascertain whether they are taking the role of bully, bully's collaborator, bully's reinforcer, or bullying victim. Another instrument validated in the study by Alcántar-Nieblas et al. (2018) is also composed of three factors: pro-bullying, pro-social and uninvolved. It is worth mentioning that the instruments of both studies were validated on elementary school students, and therefore its application on secondary school or high school students is compromised. This is of critical importance as the prevalence of school bullying during adolescence is high and represents a major educational and public health issue (Organization for Economic Co-operation and Development,

2017; United Nations Educational, Scientific and Cultural Organization, 2019).

Because of that, there is a clear need for an instrument that measures the roles of students in bullying situations while offering: 1) convenience to apply, score, and a capability to analyze results in large-scale studies; 2) the possibility of obtaining a profile of the roles involved in the cycle of violence and bullying as indicated by well-established theories on this topic (e.g., Olweus, 1993; Salmivalli et al., 1996); 3) validation for a vulnerable and potentially vulnerable population, intended for students at secondary schools where the prevalence of bullying is high and represents a public health issue (Organization for Economic Co-operation and Development, 2017; United Nations Educational, Scientific and Cultural Organization, 2019); and 4) evidence of factorial invariance that delivers elements supporting the equivalence of a construct for both genders.

Interested in solving the limitations of measurement instruments to conduct large-scale comparative studies in terms of school bullying, Rodríguez-Macías et al. (2017) developed the Scale of the Students' Role in the Cycle of School Violence (ERECVE, in Spanish). This instrument, like others of its kind, was developed with a self-reporting format, seeking to ensure its large-scale applicability and ease of use; it consists of a small but sufficient number of items in each of the five factors in which its internal structure is organized: *victim's role* (k = 5), *defender or conciliator's role* (k = 4), *sole bully's role* (k = 3), *social bully's role* (k = 4) and *bystander's role* (k = 3). Proposing few items helped reduce the extension of the instrument and the application and response time; this guaranteed a proper representation of the roles taken by students in different situations of bullying and school violence according to Olweus. (1983) and Salmivalli et al. (1996). Moreover, its application was carried out with adolescent students, fulfilling the validation criteria for potential and vulnerable population of interest (Rodríguez-Macías et al., 2017; Sánchez-Ariza, 2019). This study aimed to further examine the analysis of evidence of dimensionality and factorial invariance to substantiate that the construct is understood in the same way among females and males, and thereby facilitate the comparative study of the roles in the cycle of school violence in secondary school students. Therefore, evidences of internal structure and factorial invariance of the ERECVE are reported according to gender in a representative sample of adolescent low secondary education students in Baja California, Mexico.

MATERIAL AND METHODS

Participants

The database used comes from the *Estrategia evaluativa integral UEE 2016–2* (*Integrated assessment strategy UEE 2016–2 of the State of Baja California*; Rodríguez-Macías et al., 2017) study applied on 15,861 Mexican students from the three grades of low secondary education (ISCED level 2; UNESCO Institute for Statistics, 2012). Following a selection process, 851 cases were removed due to missing values, reading errors and response patterns. Subsequently, an additional 1,621 cases that presented outliers in the ERECVE *General index* (GI) were eliminated as well (scores lower than 25 and higher than 43). In total, the results from 13,389 cases were considered for this study. The distribution of students according to gender was 6,935 females (51.8%) and 6,454 males (48.8%); females had a mean age of 13.08 years (SD = 0.96) and males 13.09 years (SD = 0.98); the mean age for first graders was 12.05 (SD = 0.98), for second graders was 13.08 (SD = 0.95) and for third graders was 14.11 (SD = 0.96). The distribution, according to the three school grades of low secondary education, was 4,632 students from the first grade (34.60%), 4,317 from the second grade (32.24%), and 4,440 from the third grade (33.16%).

Instrument

The ERECVE is a self-reporting instrument devised by Rodríguez-Macías et al. (2017) for the *Integrated assessment strategy UEE 2016–2 of the State of Baja California*, which encompasses categories established according to the approach of school bullying as a group violence process (Olweus, 1993; Salmivalli et al., 1996) and to the PRQ created by Salmivalli et al. (1996). The ERECVE consisted of 19 items with five ordinal response options (never, rarely, monthly, weekly, and daily) in which the student indicated how often they experienced various events related to roles of participation in bullying and school violence. For the statistical analyses on the data, the response options ranged from 1 for never to 5 for daily. These items were distributed into five subscales: *victim's role*, *defender* or *conciliator's role*, *sole bully's role*, *social bully's role* and *bystander's role*. Sánchez-Ariza (2019) reported that the ERECVE shows acceptable reliability (α = 0.71, ρ = 0.79, ω = 0.77) and total item-score correlation indices (Rpbis = 0.28). Likewise, an acceptable fit was obtained for the original five-factor model (χ^2 = 34,686.86, *df* = 171, $p < 0.00$, CFI = 0.91, TLI = 0.89, RMSEA = 0.048, IC = 95% [0.047, 0.050]), SRMR = 0.38). The subscales and the items of ERECVE are shown in **Table 1**.

Data Analysis

Data analysis was organized in three stages: 1) obtaining descriptive statistics and analyses on normality, linearity, multicollinearity and reliability assumptions; 2) dimensionality analysis using Confirmatory Factor Analysis (CFA); and 3) factorial invariance analysis through Multigroup Confirmatory Factor Analysis (MGCFA). Statistical tests and analyses were performed using the RStudio software through various statistical packages, in particular: *dplyr* and *plyr*, to organize data and obtain descriptive statistics; *corrplot* to obtain the correlation matrix between items; *lavaan* to formalize the model structure and obtain fit values; and *semTools* to carry out sequential comparisons between nested models. In addition, *IBM SPSS* and *AMOS* were used to generate graphs and validate the obtained data.

During the first stage, the mean scores and standard deviation of general index and global scale of ERECVE were calculated. GI was obtained by the sum of the gross score of the participants in each item, meanwhile, *Global scale* (GS) was obtained by

TABLE 1 | Subscales and items of the Scale of the Role of Students in the Cycle of School Violence (ERECVE).

Subscale	Item coding	Item
Victim's role	S144.1	I experience violence from my classmates
	S144.2	I suffer violence from classmates in other classrooms
	S144.3	I experience violence from any of the teachers at my school
	S144.4	I experience violence from a member of the school staff
	S144.5	I experience violence from peers outside my school or in the community where I live
Defender or conciliator's role	S143.2	I meet with a group of classmates for extracurricular activities
	S143.4	I meet outside of school with a group of friends for sports or cultural activities
	S143.6	I volunteer to help people in vulnerable conditions
	S143.8	I help other classmates who are in trouble to improve their situation
Sole bully's role	S144.6	I practice violence against my classmates
	S144.7	I practice violence on my classmates in other classrooms
	S144.8	I engage in peer violence outside of my school or in the community where I live
Social bully's role	S143.1	I get together with a group of friends to practice violence on classmates in my school
	S143.3	I get together outside of school with a group of friends to vandalize
	S143.5	I vandalize to receive admiration from my friends
	S143.7	I practice violence on other classmates to feel superior to them
Bystander's role	S144.9	I see violence among my classmates
	S144.10	I see violence among classmates in other classrooms
	S144.11	I see violence among peers in my school and in other schools or in the community where I live

Note. *original items of the scale are written in spanish.*

calculating of the average score of the scale items. Given the purpose of this study, the statistical values were calculated dividing the participants by gender. Furthermore, the normality, linearity, reliability and multivariate normality assumptions were verified. The Lilliefors-corrected Kolmogorov-Smirnov goodness-of-fit comparison test was conducted to verify the normality assumptions; a $p > 0.03$ result (Dallal and Wilkinson, 1986) suggests a normal data distribution. The multivariate normal distribution was determined using the Bartlett sphericity test and the Measure of Sampling Adequacy (MSA) by Kaiser-Meyer-Olkin (KMO); a criterion of $p \leq 0.50$ was set for the Bartlett test (Hair et al., 2019) and MSA ≥0.70 for KMO (Hill, 2011; Hair et al., 2019). In turn, the *Cronbach's alpha* (α), *Rho ordinal standardized alpha* (ρ), and *McDonald's Omega coefficient* (ω) indices were calculated for the ERECVE item's reliability analysis; the established cutoff criteria were $\alpha \geq 0.70$, $\rho \geq 0.70$ (Hair et al., 2019) and $\omega \geq 0.80$ (Nájera-Catalán, 2019).

In the second stage, a CFA was conducted with the purpose of validating the reconfigured structure of the original ERECVE five-factor model as reported in earlier studies (Rodríguez-Macías et al., 2017; Sánchez-Ariza, 2019). The CFA was performed using the maximum likelihood estimation method; to that end, Hu and Bentler (1999) recommendations regarding model fit assessment were observed. The fit indices and criteria suggested by the authors are: Comparative Fit Index (CFI) ≥ 0.95, Tucker-Lewis Index (TLI) ≥ 0.95, Standardized Root Mean square Residual (SRMR) ≤ 0.08 and Root Mean Square Error of Approximation (RMSEA) ≤ 0.06.

For the third and last stage, an MGCFA was conducted to obtain the factorial invariance by gender; the reconfigured model obtained from the CFA of the previous stage served as a baseline. The recommendations by Bryne et al. (1989), Jöreskog and Sörbom (1979), Jöreskog (1971) and Vandenberg and Lance (2000) were followed to conduct the MES analysis using the sequential restriction procedure, which focuses on comparing models with increasingly restrictive specific parameters. It was determined whether the reconfigured model's structure had the same fit for both female and male (configurational invariance), whether factorial loads on both groups were equal (metric invariance), whether the reported scores were related to latent scores (scale invariance), and whether they had the same measurement error level for each item between both groups (invariance of error variance). A common criterion for considering factorial invariance as adequate is that the difference of chi-square ($\Delta\chi^2$) is not significant ($p > 0.05$). However, because the $\Delta\chi^2$ calculation varies according to the sample size, several authors (e.g., Vandenberg and Lance, 2000; Cheung and Rensvold, 2002) recommend calculating fitness indices unaffected by the sample size, such as CFI and RMSEA. Therefore, the criteria to consider the invariance assumption as valid in this study were: a CFI difference between models smaller than −0.01 (ΔCFI $p < -0.01$) and RMSEA approaching or smaller than 0.06 (RMSEA <0.06).

RESULTS

Descriptive Analyses and Validation of Preliminary Assumptions

The mean score of GI in the ERECVE was 33.48 (SD = 3.90) and the mean score for female and male students was 33.33 (SD = 3.85) and 33.65 (SD = 3.96), respectively. Means and standard deviations of scores of the GS of the ERECVE ranged between 1.04 and 4.05 and between 0.26 and 1.37, respectively. The mean scores of the GS and by-gender of the ERECVE are presented in **Table 2**. Likewise, **Figure 1** shows distributions of the mean scores of the participants by-subscale.

In terms of the ERECVE scores, the results of the application allow for comparisons in the prevalence of bullying with other

TABLE 2 | Global and by-gender descriptive statistics of the ERECVE items.

Subscale	Item	Global		Female		Male	
		M	SD	M	SD	M	SD
Victim's role	S144.1	2.09	1.19	2.12	1.17	2.05	1.22
	S144.2	1.04	0.26	1.03	0.25	1.04	0.27
	S144.3	2.21	1.32	2.07	1.23	2.36	1.40
	S144.4	1.06	0.28	1.04	0.27	1.07	0.30
	S144.5	1.95	1.10	1.92	1.06	1.97	1.13
Defender or conciliator's role	S143.2	3.91	1.19	3.88	1.17	3.95	1.22
	S143.4	1.13	0.55	1.09	0.45	1.17	0.60
	S143.6	1.14	0.52	1.09	0.45	1.18	0.58
	S143.8	1.23	0.59	1.19	0.55	1.27	0.62
Sole bully's role	S144.6	1.04	0.23	1.03	0.021	1.05	0.25
	S144.7	2.67	1.37	2.80	1.39	2.54	1.34
	S144.8	1.76	1.09	1.80	1.11	1.71	1.06
Social bully's role	S143.1	1.24	0.73	1.20	0.65	1.28	0.79
	S143.3	3.79	1.32	3.93	1.23	3.64	1.40
	S143.5	4.05	1.10	4.07	1.06	4.03	1.13
	S143.7	3.33	1.37	3.19	1.39	3.46	1.34
Bystander's role	S144.9	1.72	1.06	1.78	1.09	1.66	1.01
	S144.10	1.62	1.01	1.66	1.02	1.57	0.98
	S144.11	1.24	0.73	1.20	0.65	1.28	0.79
	Mean	2.01	0.90	2.0	0.85	2.01	0.92

populations. It's found that approximately one in six (17.5%) Baja Californian youth suffer bullying situations by their classmates and approximately one in eleven (8.7%) suffer bullying by peers from other classrooms or grades. Likewise, bullying in Baja California is lower than the global average (one of every three students; United Nations Educational, Scientific and Cultural Organization, 2019). ERECVE results are consistent with the prevalence rates of bullying in Mexican populations (Organization for Economic Co-operation and Development, 2017; Vega-Cauich, 2019), where it is estimated that one in five students suffer bullying by their school peers.

Furthermore, the examinees indicate that they exercise violence toward their classmates inside the institution at least once a week and outside the institution at least once a month. Lastly, it was found that the other situations of bullying and violence outlined by the ERECVE occur *rarely* or *not at all*. In view of the foregoing, we suggest that most of the surveyed students take the *victim* and *sole bully* roles during the school bullying and violence process. These results differ from the prevalence reported in international studies, where the roles associated with *social bully*, *bystander* or *defender* are the most frequent (Salmivalli et al., 1996; Sutton and Smith, 1999; Goossens et al., 2006). In Mexico, the study by Alcántar-Nieblas et al. (2018) indicates that students take roles similar (pro-social and uninvolved) to *defender* or *bystander* more frequently.

Regarding the results of the preliminary analyses of the technical quality of the ERECVE, the Lilliefors-corrected Kolmogorov-Smirnov goodness-of-fit comparison test yielded an adequate result, so the normality assumption in the ERECVE GI scores was accepted. The reliability analysis yielded GI scores of $\alpha = 0.72$, $\rho = 0.73$, and $\omega = 0.80$ (see **Table 3**), which were similar to the ones reported in other research efforts (Rodríguez-Macías et al., 2017; Sánchez-Ariza, 2019) and allowed to validate the ERECVE reliability assumption. Regarding the multivariate normality assumption, the KMO test results suggest a high correlation between the variables (MSA = 0.76); moreover, the results from the Bartlett sphericity test were convergent and significant ($\chi^2 = 50{,}823.27$; $df = 171$; $p < 0.001$), so the results from the ERECVE are deemed to comply with a multivariate normal distribution.

Confirmatory Factor Analysis

The original ERECVE five-factor model had a fit deemed insufficient according to the *a-priori* established criteria ($\chi^2 = 4{,}152.42$, $df = 142$, $p < 0.00$, CFI = 0.92, TLI = 0.90, RMSEA = 0.046, IC 95 [0.045–0.47], SRMR = 0.037); in particular, the CFI and TLI indices did not show values equal or higher than the required threshold. With the purpose of improving the model's fit, and because of its high values for the standardized residual covariance, item S144.3 was removed (*I experience violence from one of my school teachers*) and covariance was distributed into four item pairs (S144.1-S144.9, S144.3-S144.4, S143.1-S143.5, and S143.6-S143.8). In so doing, the revised five-factor model presented fit values above the *a-priori* established criteria ($\chi^2 = 1{,}999.70$, $df = 121$, $p < 0.00$, CFI = 0.96, TLI = 0.95, RMSEA = 0.034, IC 95 [0.033–0.35], SRMR = 0.030). Most of the correlations among the five-factors showed moderate to high values, both positive and negative (**Figure 2**). The standardized factorial loads of the revised model showed adequate values and were statistically significant ($p < 0.01$): for the first factor (*victim's role*) they ranged between 0.22 (S114.4) and 0.55 (S144.2); for the second factor (*defensor's role*), between 0.46 (S143.8) and 0.54 (S143.4); for the third factor (*sole bully's role*), between 0.50

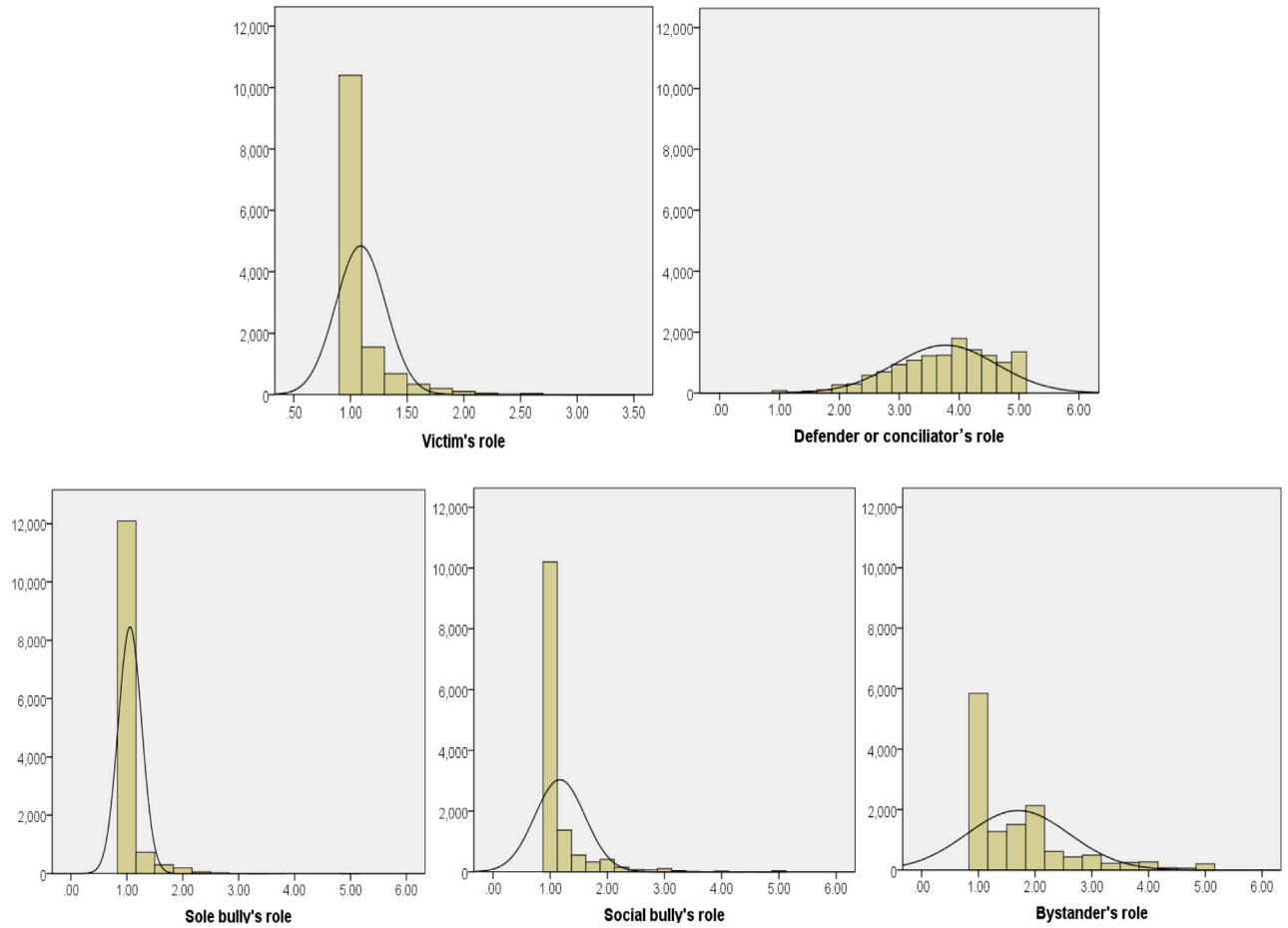

FIGURE 1 | Distribution of mean scores of each subscale of ERECVE *Note*. Mean scores of the ERECVE subscales were: for the *victim's role*, 1.09 (SD = 1.06); for the *defender's or conciliator's role*, 3.77 (SD = 1.25); for the *sole bully's role*, 1.05 (SD = 0.28); for the *social bully's role*, 1.17 (SD = 0.60); and for the *bystander's role*, 1.70 (SD = 1.05).

(S144.8) and 0.65 (S144.7); for the fourth factor (*social bully's role*), between 0.60 (S143.7) and 0.73 (S143.5); and for the fifth factor (*bystander's role*), between 0.68 (S144.11) and 0.91 (S144.10).

Factorial Invariance

An MGCFA was conducted with the purpose of examining whether both female and male low secondary education students conceptualized school violence equally. Having assessed that the five-factor model's structure was the same for both groups (configurational model), the obtained results indicated acceptable fit values (χ^2 = 2,297.6, *df* = 244, $p < 0.05$, CFI = 0.955, RMSEA = 0.035), so the assumption that the model's internal structure was the same for both groups was deemed acceptable. Moreover, evidence of invariance was obtained for the weak (ΔCFI = −0.002, ΔRMSEA = 0.000), strong (ΔCFI = −0.009, ΔRMSEA = 0.003), and strict (ΔCFI = −0.006, ΔRMSEA = 0.001) models. These results validate the assumptions on equivalence of factorial loads, intercepts and error variance between both subgroups. Fit indices and comparisons among nested models are shown in **Table 4**.

TABLE 3 | Scale and subscale internal consistency values of the ERECVE.

Subscale	α	ρ	ω
Victim's role	0.70	0.71	0.58
Defender or conciliator's role	0.83	0.83	0.61
Sole bully's role	0.61	0.62	0.63
Social bully's role	0.54	0.58	0.70
Bystander's role	0.61	0.63	0.83
Scale	0.72	0.73	0.80

Note. *Cut-off values for α and ρ indexes were ≥0.70 (Hair et al., 2019) and for ω index was ≥0.80 (Nájera-Catalán, 2019).*

DISCUSSION AND CONCLUSIONS

Internal Structure of ERECVE

School bullying is a topic of interest for both educational and government institutions. This phenomenon is characterized by its collective nature and the roles that each of the participants may take (Olweus, 1993; Salmivalli et al., 1996; Salmivalli, 2010). For

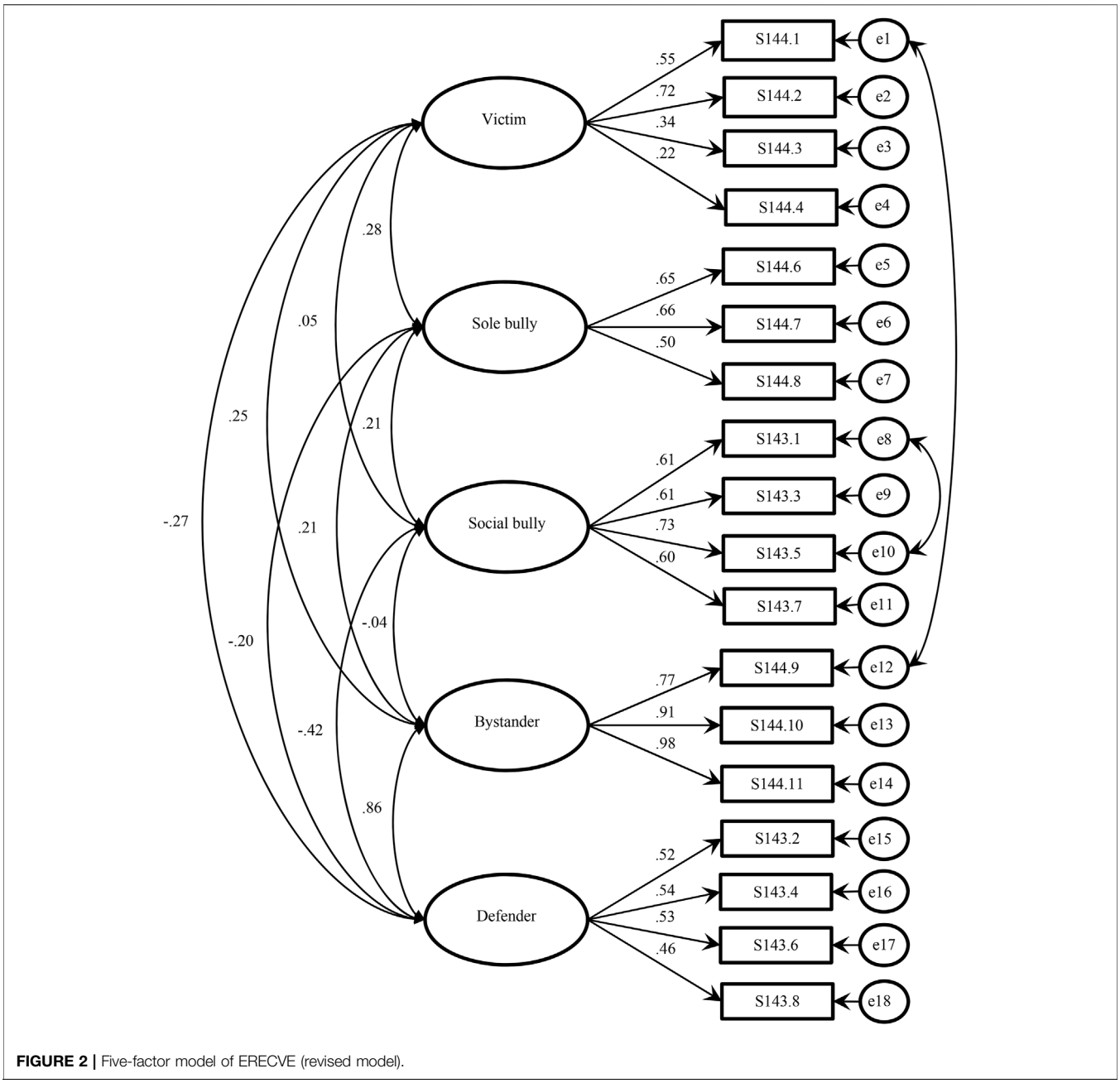

FIGURE 2 | Five-factor model of ERECVE (revised model).

TABLE 4 | Comparison of fit indices among nested ERECVE models.

Model	$\chi 2$	$\Delta\chi 2$	*df*	CFI	ΔCFI	RMSEA	ΔRMSEA
Configurational	2,297.6		244	0.955		0.035	
Weak	2,384.7	87.01	257	0.953	–0.002	0.035	0.000
Strong	2,843.8	459.14	270	0.944	–0.009	0.038	0.003
Strict	3,087.0	243.21	275	0.938	–0.006	0.039	0.001

Note. *CFI, comparative fit index; RMSEA, root mean square error of approximation.*
*$p < -0.01$.

this research, different analyses were carried out to obtain metric evidence of construct validity regarding of the internal structure and factorial invariance aspects of the ERECVE. The accomplishments and contributions linked to the procurement of said evidence are of different hierarchies. First, it was verified that the ERECVE results possess appropriate metric properties consistent with previous studies (Rodríguez-Macías et al., 2017; Sánchez-Ariza, 2019). Secondly, we obtained evidence of construct validity of the internal structure aspect. The model proposed by Rodríguez-Macías et al. (2017) and validated by Sánchez-Ariza (2019) was revised; the revised model kept the five original factors (see **Figure 1**) matching each of the roles seen in situations of school bullying and violence (Salmivalli et al., 1996; Salmivalli, 2010). The changes made to the original model were: 1) removal of item S144.3 from factor 1; and 2) distribution of error variance into four item pairs. Thereby, the revised model showed fit indices exceeding the criteria suggested by MES specialists (Hu and Bentler, 1999; Vandenberg and Lance, 2000; Cheung and Rensvold, 2002) and above those reported by Sánchez-Ariza. (2019). In view of the foregoing, the ERECVE internal structure is deemed to offer advantages by accurately identifying the roles taken by the students compared to other instruments that group several roles within one same factor.

Thirdly, the correlations among the revised model factors underscore several important considerations. On the one hand, results are similar to those obtained by Sánchez-Ariza. (2019) and measurements are therefore consistent. On the other hand, several researchers have reported results similar to the correlations of latent variables found in this study. Evidence of correlation was found between seemingly incompatible roles, however, the roles taken by students might change depending on the underlying social context, and thus it is possible that, for example, one individual takes the role of *bully* and *victim* at the same time according to the circumstances during the bullying situation (Salmivalli et al., 1996; Gumpel et al., 2014; Menesini and Salmivalli, 2017).

The *victim's role* factor presents moderate positive correlations ($r = 0.28$ and 0.25) with the *sole bully's role* and *bystander's role*; low correlation ($r = 0.05$) with the *social bully's role*; and moderate negative correlation ($r = -0.27$) with the *defender's role*. In terms of the correlation between the *victim* and *sole bully* roles, authors such as Goossens et al. (2006) and Salmivalli (2010) conceptualize it as a subgroup of the *victim's role*, naming it *victims-bullies*. Their distinctive characteristics are increased levels of anxiety and being prone to respond aggressively to provocation from their peers (Salmivalli, 2010). No clear correlation was found with regards to the *victim-bystander* pair. Written sources report that students taking the *victim's role* and the *bystander's role* are considered weak among their peers, however, bystanders exhibit more pro-social behaviors (Pouwels et al., 2016). Similarly, Gumpel et al. (2014) and Olweus (1993) indicate that bystanders see the victim as outsiders to the social group and justify the aggressions inflicted upon the victims at some degree.

In addition, we recommend a more thorough research focusing on the relationship between the *bystander's role* and *victim's role*. The low correlation in terms of the association between the *victim's role* and the *social bully's role* is thought to stem from the fact that victims tend to be rejected by the group members, besides from showing clear differences with regards to social skills (Olweus, 1993; Salmivalli et al., 1996; Salmivalli, 2010). Lastly, the negative correlation between the *victim* role and the *conciliator's role* can be explained by the fact that students who perform help or cooperation acts are negatively associated with the *victim's role* (van den Berg and Cillessen, 2013) and because of the sharp differences in social skills (Olweus, 1993; Salmivalli et al., 1996; Salmivalli, 2010).

The *sole bully's role* presents moderate positive correlations ($r = 0.21$) with the *social bully's role* and *bystander's role* factors. Regarding the *sole bully-social bully* relationship, both are considered to exercise violent behaviors, with the most notable difference being that the sole bully is a leader, whereas social bullies act as their henchmen (Olweus, 1993; Salmivalli et al., 1996; Salmivalli, 2010). The moderate relationship between the *bully's role* and the *bystander's role* is thought to be a result of them being potentially aware of other violent acts by taking part in violent acts in the first place; however, they do not participate as social bullies.

The correlations of the *defender's role* factor have negative coefficients with each of the other factors. This indicates that students showing friendship ties with their peers and participating in activities that benefit the community (volunteering, cultural activities, support to others, etc.) are less prone to commit or tolerate school bullying or violence acts. Several studies show to what results this relationship converges (e.g., Veenstra et al., 2005; Crespo-Ramos et al., 2017). Nevertheless, some studies have yielded dissenting results, for example, Demaray et al. (2016) found that students taking the *defender's role* correlate negatively with the ability to maintain interpersonal relationships. Likewise, Cillessen and Mayeux. (2004) and Lucas-Molina et al. (2014) suggest that students associated with this role exercise violent behaviors, especially when confronting the sole and social bullies.

Factorial Invariance Across Gender of ERECVE

Results from the MGCFA support the evidence of factorial invariance across genders for the ERECVE. Having obtained acceptable fit indices during the sequential comparison of nested models, surveyed men and women can be considered to conceptualize school bullying and violence in the same manner. Any score difference between men and women is deemed to convey the individual variability of the construct and not a rationale for bias due to the examinee's gender. This represents a step forward in measuring the roles of school bullying and violence. Although similar instruments have previously obtained evidence for factorial invariance (Lucas-Molina et al., 2014; Alcántar-Nieblas et al., 2018), the ERECVE is considered a feasible alternative for measuring school bullying and violence at a large scale in secondary school institutions within the Mexican education system.

Limitations

Among the limitations of the present study, each of the scales presented internal consistency values below the criteria

established *a-priori* (see **Table 3**). The *victim*, *sole*, *social* and *defender* scales have inadequate values in the ω index and the *sole*, *social* and *bystander* scales have inadequate values in α and ρ indexes. Low α values can be explicated due to tau-equivalence violation (Green and Yang, 2009) and the item scores weren't continuous (Gadermann et al., 2012). Inadequate values of ω and ρ indexes suggest a thorough revision of the scale. Results of internal consistency analysis ($\alpha = 0.81$ to 0.93) don't coincide with those reported by Salmivalli et al. (1996), however, it's important to remember that this study was applied in a population of 573 Finnish children, in addition to using the original instrument which has a greater number of items. Likewise, they do not report the results of the ρ and ω indexes, which have greater precision in the type of instruments used in this study.

CONCLUSION

The results of the confirmatory analysis provided relevant information on the factorial structuring of the five-factor ERECVE model. It was concluded that the reconfigured five-factor model can be used as a quality measure to explore students' roles in the cycle of school violence on a large scale. Also, simultaneous measurement invariance is achieved, which may favor the analysis of mean differences between genders. However, it is advisable to review the dimensions and items with inadequate internal consistency values of the ERECVE and to review with specialists in the field the possibility of incorporating more items that better represent the construct of interest. For future research efforts, it is recommended to apply and obtain evidence of validity of the ERECVE in the primary and secondary population. Also, given the high prevalence of online aggression and bullying among adolescents and the health effects and correlation between cyberbullying and traditional bullying (Iranzo et al., 2019; Vega-Cauich, 2019; Zych et al., 2019) it is suggested to include at least one factor with items referring to online bullying and aggression among students.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: The funding agency permits the use of the data for psychometric analysis and to obtain evidence of validity of the instruments. However, it is not allowed to report results concerning participants or the publication of the data. Due to restrictions, the database of the present study cannot be uploaded. Requests to access these datasets should be directed to juancr_mx@uabc.edu.mx.

AUTHOR CONTRIBUTIONS

JP-M and JR-M. JP-M: Directed the data analysis and interpretation, contributed to the conceptualization of the research, and was responsible for drafting the manuscript. He was also responsible for revising the English version and editing in Frontiers format. JR-M: Contributed to the conceptualization of the research idea and study method, data collection, and drafting of the manuscript. She also contributed to the analysis and interpretation of the data, as well as to the revision of the English version and writing in Frontiers format.

FUNDING

This study was financed by the *Instituto de Servicios Educativos y Pedagógicos de Baja California*, who granted the resources to the *Unidad de Evaluación Educativa* of *Instituto de Investigación y Desarrollo Educativo* of the *Universidad Autónoma de Baja California* through *Convenio Marco* para el desarrollo de los programas federales del ejercicio 2015, denominated *Fortalecimiento de la Calidad en Educación Básica* under Program Code 77-039-821 Item Budget Number 3334001.

ACKNOWLEDGMENTS

A special acknowledgement is made to Mario Gerardo Herrera-Zarate, Secretary of Education of the Baja California State Education System, who proposed the research project and managed the financial resources to carry it out. We also acknowledge the support of Joaquín Caso-Niebla, Director of the *Instituto de Investigación y Desarrollo Educativo* of the *Universidad Autónoma de Baja California*, who provided the administrative facilities.

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