

Measuring Educational Equity in Large-Scale Assessments: Indicators, Dimensions, and Associated Factors. A Systematic Review

Medición de la equidad educativa en evaluaciones a gran escala: indicadores, dimensiones y factores asociados. Una revisión sistemática

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Abstract

Education systems play a key role in ensuring equal access through policies aimed at promoting quality and equity. Educational equity seeks to guarantee the development of individual potential regardless of social background or other personal circumstances. International large-scale assessments (ILSAs) provide relevant data for analyzing education systems in this area. The aim of this systematic review is to analyze the indicators used to assess educational equity in the context of ILSAs (equality of outcomes, equality of opportunity, and socio-economic segregation) and to identify key contextual and educational factors associated with them. Following the PRISMA guidelines, this review found a lack of consensus in the scientific literature regarding measurement strategies and indicator selection. Most studies focus on contextual factors (gender or migrant background) and educational policies linked to the commodification of education (including early tracking, school choice policies, and the expansion of private schooling), which are associated with higher levels of inequality. In contrast, some educational factors emerge as protective elements at the individual level, including academic expectations, teacher training, teaching methodologies, and support for students with learning difficulties.

Keywords: resilience, equity, academic achievement, equal opportunity in education, socio-economic status

Resumen

Los sistemas educativos desempeñan un papel clave en la garantía de la igualdad de acceso mediante políticas orientadas a promover la calidad y la equidad. La equidad educativa busca garantizar el desarrollo del potencial individual sin importar el origen social u otras circunstancias personales. Las evaluaciones internacionales a gran escala (ILSA, por sus siglas en inglés) proporcionan datos relevantes para el análisis de sistemas educativos en este ámbito. Esta revisión sistemática tiene por objetivo analizar los indicadores utilizados para evaluar la equidad educativa en el contexto de las ILSA (igualdad de resultados, igualdad de oportunidades y segregación socioeconómica) e identificar factores



contextuales y educativos clave asociados. Siguiendo las directrices PRISMA, en esta revisión se identificó una falta de consenso en la literatura científica en lo que respecta a las estrategias de medición y la selección de indicadores. La mayoría de los estudios se centran en factores contextuales (el género o el origen migrante) y políticas educativas vinculadas a la mercantilización de la educación (como el agrupamiento temprano por capacidad, la elección de escuelas y la expansión de la educación privada), las cuales se asocian a mayores niveles de desigualdad. Por otro lado, algunos factores educativos emergen como elementos protectores a nivel individual, entre ellos las expectativas académicas, la formación docente, las metodologías de enseñanza y el apoyo a alumnos que presentan dificultades de aprendizaje.

Palabras clave: resiliencia, equidad, rendimiento escolar, igualdad de oportunidades educativas, estatus socioeconómico



I. Introduction

Education systems provide access to education, regulate teaching, and convey culture; they play a key role in vocational and general education and in poverty reduction (Kyriakides & Creemers, 2018). Accordingly, education policies contribute to enhancing system quality (European Commission & Eurydice, 2015), and research continues to explore how to improve educational outcomes by identifying key factors such as school funding, teacher salaries, school organization, and teaching strategies (Teddle & Reynolds, 2000; Vigdor & Nechyba, 2007).

In recent years, international large-scale assessments (ILSAs) have become central instruments guiding educational policies aimed at quality improvement. As noted by Lu et al. (2024), “standardized test performance has become the most powerful indicator of school quality in many league tables” (p. 3), as these assessments provide evidence on system evolution and current performance, particularly with regard to school effectiveness (e.g., Hopfenbeck et al., 2018) and educational equity (e.g., Kyriakides & Creemers, 2018; OECD, 2012). Educational equity is grounded in the principle that all students should be able to reach their full potential (Levin, 2003; OECD, 2012; UNESCO, 2007), acknowledging learner diversity and the responsibility of educational systems to respond to it (Maiztegui-Oñate & Santibáñez-Gruber, 2008). In empirical research, it is commonly operationalized through distinct analytical dimensions that capture different aspects of fairness in educational systems. Although equal academic outcomes cannot be expected for all students (Field et al., 2007), education systems must provide supportive environments that foster the development of each learner’s capabilities (Levin, 2003; OECD, 2012; UNESCO, 2007).

Research on school effectiveness is extensive, beginning with the Coleman Report (Coleman et al., 1966) and the Effective Schools Movement (Chitty, 1997), and culminating in several systematic reviews (Broer et al., 2019; Javornik & Klemenčič, 2023). In contrast, research on educational equity remains less consolidated and is characterized by a lack of standardized statistical procedures for its measurement (Enchikova et al., 2024). Notably, systematic literature reviews (SLRs) focusing explicitly on equity measurement are scarce.

Existing reviews addressing educational equity tend to either consider it as a secondary dimension within broader analyses of school effectiveness (Hopfenbeck et al., 2018; Mejía-Rodríguez & Kyriakides, 2022), performance determinants (Zheng et al., 2024), or educational policy impacts (Tobin et al., 2016), or focus on specific aspects such as its conceptualization (Appels et al., 2023), historical evolution (Enchikova et al., 2024), or the magnitude of the association between socioeconomic status (SES) and academic performance (Liu et al., 2022). Complementarily, recent work has examined the normative and philosophical assumptions underlying equity indicators, highlighting the non-neutral foundations of statistical measurement and discussing UNESCO’s (2018) proposals within the Rawls–Sen debate, while advocating for more pluralistic conceptualizations of equity (García & Giovine, 2025). However, despite these contributions, to our knowledge, no previous reviews have systematically examined how educational equity is operationalized, the level of consensus regarding measurement indicators, or the contextual and educational factors associated with equity outcomes across studies.

Despite these contributions, important gaps remain. Existing reviews have focused on the conceptualization, historical evolution (Enchikova et al., 2024), or overall effects of educational equity (Appels et al., 2023), but they have not systematically examined how equity is operationalized through empirical indicators in ILSA-based research or the degree of consensus regarding these indicators across dimensions such as equality of outcomes, equality of opportunity, and school segregation.



To address this gap, the present study makes three contributions: (1) it maps the indicators used to assess educational equity in ILSA-based research; (2) it differentiates the main dimensions of equity conceptually and methodologically; and (3) it identifies the contextual and educational factors associated with each dimension.

Against this backdrop, and given that most empirical research conceptualizes educational equity through the relationship between SES and academic achievement, the present review examines studies using these variables as input-output factors, pursuing the following objectives:

- Analyze the indicators used to assess educational equity in ILSA-based research, differentiating between equality of outcomes, equality of opportunity, and school segregation.
- Identify the key contextual and educational factors associated with each of these dimensions of educational equity.

1.1 Concept of educational equity

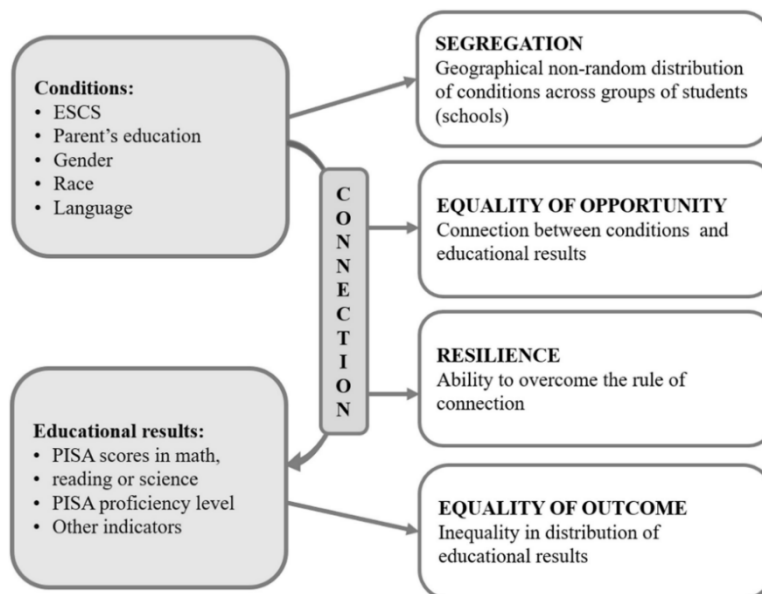
To improve conceptual clarity, this study adopts a multidimensional approach to educational equity, distinguishing three related but distinct dimensions. Equality of outcomes refers to the distribution of educational results across students or schools regardless of background characteristics. Equality of opportunity concerns the extent to which outcomes are independent of students' initial conditions, particularly socioeconomic background. School segregation refers to the unequal distribution of students across schools according to social or personal characteristics. Although interrelated, these dimensions capture different aspects of educational equity and are operationalized through distinct indicators.

Some authors describe educational equity as a multifaceted and contested concept that is interpreted from different perspectives (Appels et al., 2023). Equity and equality are sometimes used interchangeably (Appels et al., 2023), although they are not equivalent (Field et al., 2007; Secada, 1989). Despite efforts to standardize its assessment (UNESCO, 2018), this conceptual ambiguity has led to a lack of consensus on how best to measure educational equity.

In this regard, a systematic review by Enchikova et al. (2024) proposes a framework for classifying equity indicators into four levels based on initial conditions (inputs) and educational results (outputs) (Figure 1).



Figure 1. Categories of Equity Indicators



Note: Enchikova et al. (2024, p.5)

Equality of outcomes examines variability in educational outputs across students or schools (Rowley et al., 2020; Strello et al., 2021). Simple measures include performance dispersion, while other studies assess outcomes at the school level using the intraclass correlation coefficient (ICC) derived from two-level (student-school) null models (Martínez-Abad et al., 2024; Murillo, 2016). The ICC reflects the degree of similarity among students within schools and differences between schools, defined as “the degree to which students within a school resemble each other and differ on average from those in other schools” (Parker et al., 2018, p. 7).

Equality of opportunity refers to the association between background conditions and educational outcomes (Enchikova et al., 2024). Measurement typically involves estimating relationships between background variables – most commonly socioeconomic status (SES) – and achievement (UNESCO, 2018), using correlation coefficients or regression models in which background characteristics represent inputs (x) and outcomes represent outputs (y). Academic resilience, understood as “the capacity of students to perform well in school despite facing socioeconomic challenges” (Enchikova et al., 2024, p. 4), is therefore used as an indicator of equality of opportunity.

School segregation is another core dimension of educational equity (Hernández-Torrano & Courtney, 2021; Perry, 2018) and refers to the unequal distribution of students across schools according to their personal or social characteristics (Murillo & Martínez-Garrido, 2018, p. 64), reflecting residential, economic, and racial segregation patterns (Holmlund & Öckert, 2021). It is commonly measured using indices such as the Gorard, dissimilarity, isolation, or square root indices, with the Gorard and dissimilarity indices being the most widely applied to socioeconomic segregation (Murillo, 2016; Murillo et al., 2023). When the dependent variable is continuous rather than dichotomous, the socioeconomic inclusion (SI) index is recommended (Holmlund & Öckert, 2021; Murillo, 2016; OECD, 2009). The SI index corresponds to the ICC of a two-level (student-school) null multilevel model using SES as the dependent variable.

Taken together, these gaps highlight the need for a systematic and analytically structured review of how educational equity is measured and studied in ILSA-based research. In response to this need, the present study compiles empirical ILSA-based research organized



around key dimensions of educational equity (Enchikova et al., 2024). The objectives are to examine the level of consensus regarding the indicators used to assess equity (based on socioeconomic inputs and achievement outputs) and to identify key contextual and educational factors associated with these dimensions. The guiding research questions are:

- RQ1. Which indicators are used in academic literature to measure the different dimensions of educational equity?
- RQ2. What key contextual and educational factors are associated with equity as equality of outcomes?
- RQ3. What key contextual and educational factors are associated with school segregation?
- RQ4. What key contextual and educational factors are associated with equity as equality of opportunity?

II. Method

Systematic reviews synthesize existing research and provide a structured basis for advancing knowledge in a given field. This study follows the PRISMA 2020 reporting guidelines for systematic reviews (Page et al., 2021), ensuring transparency and completeness in the reporting of the review process.

2.1 Database and search string

The Web of Science (WoS) and Scopus databases were selected due to their wide coverage of peer-reviewed scientific literature. Following the literature review and initial conceptualization, the following search string was defined:

(equity OR inequity OR segregation OR equality OR inequality OR "social justice") AND ("Large-Scale Assessment" OR ILSA OR PISA OR PIRLS OR TIMSS OR ERCE OR TERCE OR SERCE OR LLECE) AND educati*

2.2 Inclusion criteria

The inclusion criteria (IC) below were formulated to ensure that the papers selected were relevant in relation to the purpose of study and the research questions proposed:

- IC1. Studies published between 2000 and 2025.
- IC2. Articles published in scientific journals.
- IC3. Research papers in English or Spanish.
- IC4. Empirical studies based on one of the following ILSAs: PISA, PIRLS, TIMSS, ERCE, TERCE, SERCE or LLECE.
- IC5. Studies applying statistical techniques to measure inequity and/or segregation based on performance and/or SES.

Studies must meet the above criteria to be considered in this analysis.

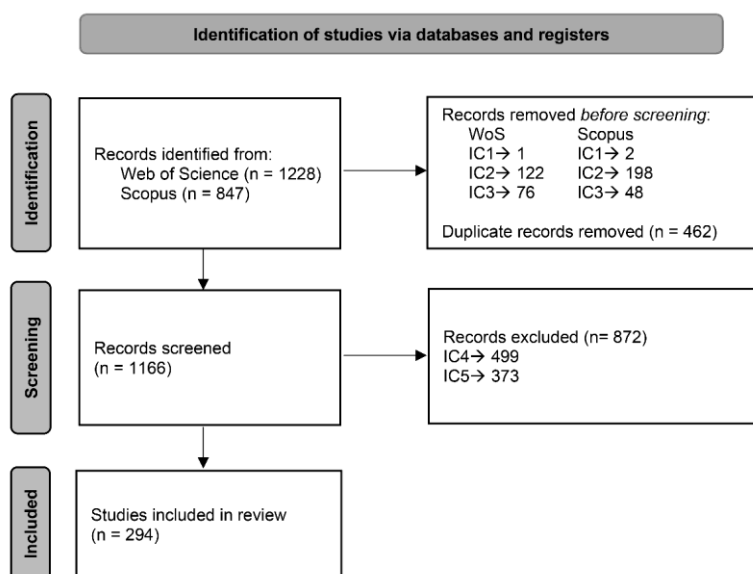
2.3 Review process

Data were retrieved on November 16, 2025. Figure 2 shows the literature review protocol followed. A total of 1,228 records were found in WoS and 847 in Scopus; criteria IC1, IC2 and IC3 were applied using database filters before eliminating duplicates. With IC1, 1 record was eliminated in WoS and 2 in Scopus. With IC2, 122 records were eliminated in WoS and 198 in Scopus. With IC3, 76 records were eliminated in WoS and 48 in Scopus. After applying the



first three inclusion criteria, a total of 1,628 records were obtained.¹ The final sample that passed the screening phase after eliminating duplicates consisted of 1,166 works;² IC4 and IC5 were then applied, eliminating 499 and 373 records respectively. The application of the five inclusion criteria yielded a final sample of 294 papers.³ The complete screening database and data extraction matrix are available in an open-access repository (<https://doi.org/10.5281/zenodo.20727844>).

Figure 2. PRISMA Flow Chart



2.4 Quality criteria

Given the large volume of papers remaining, quality criteria (QC) were included after applying the inclusion criteria. The following quality criteria were proposed based on similar previous studies:

- QC1. The article focuses on equity or segregation as a main phenomenon of the study (criterion/dependent variable).

Scores for this quality criterion: Yes = 2 (the paper focuses on equity/segregation); Partially = 1 (equity/segregation is a secondary theme); No = 0 (equity/segregation is not explicitly addressed).

- QC2. The abstract follows the IMRaD format, clearly presenting the objective, methods and outcomes.

Scores for this quality criterion: Yes = 1 (the abstract adheres to the IMRaD format); Partially = 0.5 (the abstract includes some elements of the IMRaD format); No = 0 (the abstract does not adhere to the IMRaD format).

¹The merged database after duplicate removal is available in worksheet "3.ID_WoS+SC" (<https://doi.org/10.5281/zenodo.20727844>).

²See worksheet "4.ID_Total" in the Zenodo screening and data extraction database (<https://doi.org/10.5281/zenodo.20727844>).

³The final sample of 294 studies included in the review is available in worksheet "5.ES_SEC" of the Zenodo repository (<https://doi.org/10.5281/zenodo.20727844>).



- QC3. The results of specific equity/inequity/segregation indicators are used to respond to the objectives/questions/hypotheses proposed.

Scores for this quality criterion: Yes = 1; No = 0.

- QC4. The authors use sampling weights in the database for analysis.

Scores for this quality criterion: Yes = 1; No = 0.

- QC5. The study includes student performance in its analysis and the use of achievement plausible values is appropriately addressed.

Scores for this quality criterion:

- i. 0 points: the authors do not explain how they worked with plausible values, or otherwise obtain an average performance variable from the n plausible values available.
- ii. 0.5 points: the analyses are conducted using a single plausible value.
- iii. 1 point: the models are estimated n times, one for each plausible value, and the statistics reported are averages of the scores obtained in the n models.

Given that studies on socioeconomic segregation do not include achievement variables to estimate this indicator, QC1-QC4 only were applied to these papers, using a weighting strategy to maintain equivalent minimum and maximum possible scores across studies.

After applying the quality criteria,⁴ the average quality score of the works was 2.92 with a standard deviation of 1.61 points. As the maximum quality score is 6, the cut-off score for the selection of articles was set at 5, following a conservative selection strategy focused on methodological rigor; a total of 37 studies were selected. This threshold ensured the inclusion of methodologically rigorous studies with equity or segregation as a central focus and at least partial consideration of the complex sampling design of ILSAs, including the use of sampling weights and/or plausible values.

Of the 37 studies included in the final sample, 28 were published in English and 9 in Spanish.

The selected papers were studied in depth by two researchers in order to answer the four RQs posed. In this analysis the researchers recorded five key aspects for each paper:

1. Categories of educational equity assessed and equity indicators obtained
2. Countries/regions participating in the study
3. ILSA or ILSAs used
4. Levels of equity obtained and evolution of equity (if applicable)
5. Analyzed factors associated with equity

After an initial independent analysis, the two researchers jointly reviewed the results, resolving disagreements through discussion and consensus.

⁴ The quality assessment scores assigned to all eligible studies are available in worksheet "6.SC_QC" of the screening and data extraction database deposited in Zenodo (<https://doi.org/10.5281/zenodo.20727844>).

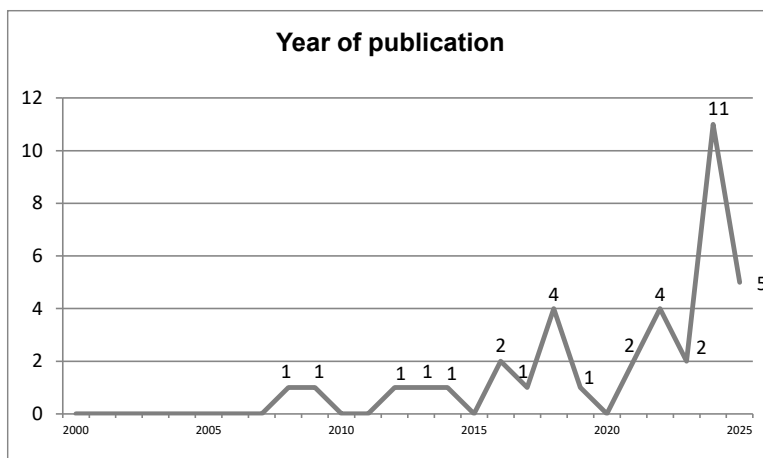


III. Results and discussion

3.1 Initial mapping

The research papers selected were published between 2008 and 2025 (Figure 3), with the number of publications increasing in later years. The highest output was observed in 2024, with 11 papers published.

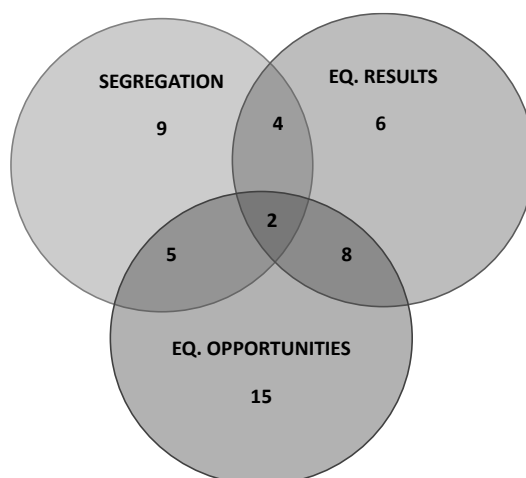
Figure 3. Number of Studies on Educational Equity in ILSA-Based Research (2000–2025)



The journal with the most publications included was *Large-scale Assessments in Education*, with five papers: three in 2022, one in 2023, and one in 2024. This is followed by *REICE-Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación*, with three papers: one in 2016 and two in 2024. Other journals with two publications each were *British Educational Research Journal*, *European Journal of Psychology of Education*, *Review of Public Economics*, *International Journal of Comparative Sociology*, *International Journal of Educational Research Open*, and *Studies in Educational Evaluation*.

The most frequently studied approaches to equity were equality of opportunity and socioeconomic segregation (Figure 4). Only two papers (Martínez-Abad et al., 2024, 2025) considered all three levels of educational equity in their analyses.

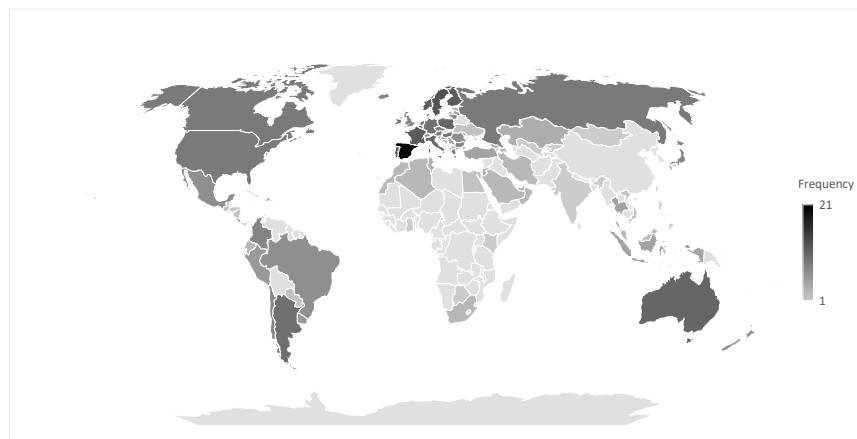
Figure 4. Distribution of Studies across Dimensions of Educational Equity





The most studied region was Europe, followed by Oceania and North America. Within Europe, Spain is the most represented country, appearing in 17 studies. Other countries, such as France, Norway, Sweden, and Finland, are also frequently represented, appearing in 10 studies (Figure 5).

Figure 5. Frequency of ILSA-Based Studies by Country/Region



In terms of data sources (Table 1), PISA is by far the most widely used ILSA, appearing in 24 studies. TIMSS and PIRLS are used less frequently, and only three studies combine multiple databases in their analyses (Brinkmann et al., 2024; Cordero & Mateos-Romero, 2021; Strello et al., 2022).

Table 1. Frequency of ILSAs

ILSA	Number of papers
PISA	24
TIMSS	5
PIRLS	3
TERCE	2
TIMSS + PIRLS	1
PISA + TIMSS + PIRLS	2

3.2 Which indicators are used in academic literature to measure the different dimensions of educational equity? (RQ1)

Educational equity is measured using a wide range of indicators, with no consistent pattern or consensus regarding their application. This heterogeneity is observed across all three dimensions of equity. Equality of outcomes is most commonly assessed through measures of performance dispersion. At the student level, standard deviation or variance are the most frequently used indicators (Ali et al., 2024; Blanco-Varela et al., 2024; Ferreira & Gignoux, 2014; García-Herrero et al., 2024; Holgado-Aguadero et al., 2025; Marrero et al., 2024), while at the school level, ICC values are used for academic performance (Brinkmann et al., 2024; Duggan et al., 2023; Martínez-Abad et al., 2025; Pongsophon, 2024; Qiu & Leung, 2022). Additional approaches, although less frequent, include percentile gaps (e.g., P90-P10) (Marrero et al., 2024), inequality indices such as the Gini coefficient (Teltemann & Schunck, 2016), and composite indicators such as the socioeducational vulnerability index (Blanco-Varela et al., 2024) and the Basic Educational Inequity Index (Formichella, 2014).

Socioeconomic segregation is measured using multiple indices, primarily the SI index (Brinkmann et al., 2024; Murillo, 2016; Murillo & Garrido, 2017; Teltemann & Schunck, 2016), the dissimilarity index (Danhier, 2018; Jenkins et al., 2008; Murillo, 2016; Murillo & Garrido,



2017; Strello et al., 2022), the Hutchens' square root index (Alegre & Ferrer, 2010; Murillo et al., 2018; Murillo & Guiral, 2024), and the Gorard index (Murillo, 2016; Murillo & Martínez-Garrido, 2019). Less frequently used measures include the isolation index (Murillo, 2016), the systematic ordinal segregation index (Ivanushina et al., 2018), and socioeconomic composition based on school-level SES averages (Perry et al., 2024). Given that Gorard, Hutchens, isolation, and dissimilarity indices rely on dichotomous criteria, they are more suitable for categorical variables such as migrant background or immigrant status (Teltemann & Schunck, 2016) than for scalar SES data. Comparative analyses indicate that the SI index offers the most robust option at the system level, as it captures the full variability of SES, although its calculation requires advanced multilevel modelling procedures (Murillo, 2016).

Measurement of equality of opportunity is more homogeneous but still lacks consensus on specific statistical techniques. Most studies estimate SES-achievement relationships using regression-based approaches, including multilevel models (Alegre & Ferrer, 2010; Cordero & Mateos-Romero, 2021; Danhier, 2018; Duggan et al., 2023; Qiu & Leung, 2022; Vicente et al., 2021), student-level multiple regression (Rupérez et al., 2018; Siebecke, 2024), quantile regression (Caro & Mirazchiyski, 2012; Perry et al., 2022), or discontinuous regression designs (Steinmann & Olsen, 2022). Alternative correlational approaches use coefficients of determination or Pearson correlations (Bencomo-Mesa et al., 2025; Enchikova et al., 2025; Ferreira & Gignoux, 2014; García-Herrero et al., 2024; Holgado-Aguadero et al., 2025; Martínez-Abad et al., 2024, 2025; Marrero et al., 2024). Group-comparison methods based on standardized mean differences (Cohen's *d*) have also been applied (Appels et al., 2024).

Equality of opportunity is additionally operationalized through academic resilience, although cutoff criteria vary considerably: bottom SES tercile and top performance quartile (Cordero & Mateos-Romero, 2021), bottom SES tercile and top achievement tercile (Vicente et al., 2021), bottom SES quartile and top achievement quartile (Sicilia & Simancas, 2023), or bottom SES quartile and achievement level 3 or higher following OECD benchmarks (OECD, 2022; Siebecke, 2024; Yang Hansen et al., 2025).

Overall, the diversity of indicators and methodological approaches across all dimensions reflects a persistent lack of standardization in the measurement of educational equity, limiting comparability, replicability, and cumulative knowledge development.

3.3 What key contextual and educational factors are associated with equity as equality of outcomes? (RQ2)

The education system plays a key role in personal development (Teltemann & Schunck, 2016), and available evidence suggests that levels of equality of outcomes have remained relatively stable over time (Ali et al., 2024), with some regional variations (Martínez-Abad et al., 2024, 2025). Research on factors associated with equality of outcomes generally distinguishes between contextual factors – including educational policies and personal characteristics – and educational factors operating at the student and school levels.

Among personal contextual factors, socioeconomic status remains the most frequently examined variable (Qiu & Leung, 2022), with gender and migration status also showing consistent, though more limited, associations (García-Herrero et al., 2024; Pongsophon, 2024; Teltemann & Schunck, 2016). Between-school equality of outcomes is closely linked to school segregation: higher socioeconomic or racial segregation is associated with greater outcome inequality. Cross-national evidence from Latin America shows persistently high levels of inequality and highlights the multidimensional nature of educational equity. Using PISA 2000 and 2009 data, Formichella (2014) showed that country rankings vary depending on the weighting assigned to quantity and quality dimensions. More recent evidence suggests moderate improvements in some countries, although high inequality levels persist



in others (Martínez-Abad et al., 2025). Policy-related contextual factors associated with greater inequality include early tracking (Ali et al., 2024; Blanco-Varela et al., 2024; Brinkmann et al., 2024; Teltemann & Schunck, 2016), the expansion of private or mixed school networks (García-Herrero et al., 2024; Holgado-Aguadero et al., 2025; Martínez-Abad et al., 2024), retention practices in place of targeted support measures (García-Herrero et al., 2024), and the absence of compensatory resource allocation mechanisms based on student or family needs (Duggan et al., 2023; Qiu & Leung, 2022; Teltemann & Schunck, 2016).

At the student level, protective educational factors include academic expectations and reading habits (Marrero et al., 2024), digital self-sufficiency, and school belonging (Pongsophon, 2024).

At the school level, positive associations with equity have been found for technological resources, leadership experience, school cultures oriented toward academic success (Pongsophon, 2024), and continuous teacher professional development (García-Herrero et al., 2024). Overall, these findings highlight the combined influence of structural conditions, policy decisions, and school-level practices in shaping equality of outcomes across education systems.

3.4 What key contextual and educational factors are associated with school segregation? (RQ3)

School segregation poses a major barrier to equality of opportunity and educational equity (Murillo & Martínez-Garrido, 2019), as it reinforces educational inequalities and constitutes a persistent policy challenge, despite the methodological complexity involved in its comparative measurement (Ivaniushina et al., 2018). Although a substantial body of research has analyzed levels of segregation – primarily socioeconomic across education systems – longitudinal evidence remains limited. To date, only Martínez-Abad et al. (2024, 2025) examine trends over time, identifying relatively stable segregation levels over the last two decades across Latin American and OECD countries participating in PISA.

Regarding associated factors, the literature focuses predominantly on education policy mechanisms, particularly those related to the marketization of education, school choice, student selection, and early tracking. Studies addressing neoliberal policy frameworks highlight how the coexistence of public systems with extensive private or mixed-school networks tends to intensify segregation, as students from lower socioeconomic backgrounds concentrate disproportionately in public schools (Martínez-Abad et al., 2024; Murillo & Garrido, 2017; Murillo et al., 2018). Even in systems with shared funding, mixed-ownership structures emerge as a significant source of segregation (Murillo & Guiral, 2024).

Flexible regulations governing school admission and parental choice further contribute to segregation (Ivaniushina et al., 2018; Jenkins et al., 2008), particularly when combined with early tracking policies, which consistently amplify between-school stratification (Brinkmann et al., 2024; Strello et al., 2022), with stronger effects among students from lower social strata (Brinkmann et al., 2024).

Overall, evidence indicates that highly marketized education systems are associated with higher levels of school segregation and resource stratification (Perry et al., 2024), whereas more comprehensive, centralized and regulated education systems tend to mitigate these effects (Alegre & Ferrer, 2010).

3.5 What key contextual and educational factors are associated with equity as equality of opportunity? (RQ4)

UNESCO defines equality of opportunity as the principle that performance should not depend on personal circumstances that stem from the randomness of birth, but on



individual effort (OECD, 2019, p. 42). Despite slight reductions observed in inequality of outcomes (Enchikova et al., 2025), evidence suggests that inequality of opportunity is increasing and that effective mechanisms to reduce it remain limited (Duggan et al., 2023; Rupérez et al., 2018). In fact, Martínez-Abad et al. (2025) found that both across OECD countries and in Ibero-American contexts, inequality of opportunity in secondary education, as measured using PISA data, has followed a sustained upward trend since 2009. Research commonly applies correlational methodologies to assess equality of opportunity, although there is no clear consensus regarding specific statistical techniques or indicators.

Most studies analyze long-term trends and investigate contextual factors associated with school success at sociopolitical, school, and student levels, particularly those linked to the marketization of education systems. At the system level, early tracking, student admission regulations, and the expansion of private or mixed school networks are consistently identified as major drivers of inequity (Alegre & Ferrer, 2010). Structural features such as cultural and political legacies, reflected in education reforms and levels of decentralization, further shape equality of opportunity (Caro & Mirazchiyski, 2012). Public spending is also associated with equality of opportunity (Vicente et al., 2021), although its effectiveness depends on strategic allocation and accountability mechanisms (Vicente et al., 2021). Higher GDP per capita, teacher salaries, and professional incentives appear positively related to equity (Rupérez et al., 2018), while regionally differentiated funding tailored to local needs improves efficiency (Rupérez et al., 2018). Early schooling also emerges as a protective factor, with longer enrollment histories associated with greater equality of opportunity (Steinmann & Olsen, 2022).

Regarding personal and school contextual factors, the impact of household resources on achievement has strengthened over time (Duggan et al., 2023). Cultural capital and parental occupation are among the most influential socioeconomic predictors (Marrero et al., 2024). Migrant or immigrant status is also associated with unequal educational opportunities and lower academic achievement in several studies (Teltemann & Schunck, 2016). School resource deficits, teacher shortages, high student-teacher ratios, and ability grouping further undermine equity (Alegre & Ferrer, 2010). Moreover, school-level SES exerts a strong influence on achievement, particularly in highly marketized systems (Marrero et al., 2024; Perry et al., 2022), where peer effects amplify disparities (Cordero & Mateos-Romero, 2021). Accordingly, policies aimed at reducing socioeconomic segregation and allocating compensatory resources – such as scholarships, grants, and additional support staff – are recommended, as they promote more equitable learning opportunities across schools (Caro & Mirazchiyski, 2012; Martínez-Abad et al., 2024, 2025; Steinmann & Olsen, 2022).

Educational protective factors consistently highlighted include academic support for struggling students (Siebecke, 2024), teacher-student trust (Perry et al., 2022), classroom methodologies and instructional strategies (Perry et al., 2022; Yang Hansen et al., 2025), and teaching experience and classroom-management training (García-Herrero et al., 2024). Additional protective influences include dropout prevention initiatives such as reinforcement, tutoring, and extracurricular support (Sicilia & Simancas, 2023); the development of non-cognitive skills that foster academic resilience among low-SES students (Cordero & Mateos-Romero, 2021); positive school climate and coexistence (García-Herrero et al., 2024; Perry et al., 2022); and active family academic support (Cordero & Mateos-Romero, 2021).

V. Conclusions

The main conclusions of this study highlight a lack of agreement and limited coherence in the approaches used to measure segregation, equality of outcomes, and equality of opportunity. These findings are consistent with the conceptual ambiguity and lack of



consensus on educational equity identified in the literature (Appels et al., 2023; Enchikova et al., 2024).

However, beyond confirming this lack of consensus, this study contributes to the literature by integrating measurement approaches and associated factors across the three main dimensions of educational equity, providing a more comprehensive and structured understanding of how equity is operationalized in ILSA-based research.

Researchers employ diverse indicators according to their underlying conceptualizations of equity or specific analytical interests, and some studies fail to clearly distinguish between equality of outcomes and equality of opportunity at the operational level. As noted by Appels et al. (2023), such interpretative inconsistencies have significant implications for educational policy decisions. Consequently, a priority area for future research is the development of a stable and shared conceptual framework that clearly defines educational equity and its measurement, enabling greater standardization, comparability, and replicability across empirical studies.

Regarding inequality of outcomes, evidence points to a slight overall decline, reflecting modest improvements in equality of outcomes across countries in Asia, Europe, and the United States (Ali et al., 2024), as well as in Latin America (Martínez-Abad et al., 2025). Despite methodological diversity, the most commonly used indicators remain performance variance at the student level and the ICC at the school level. Key associated factors include personal contextual characteristics (SES, gender, migration status), national education policy configurations (early tracking, school ownership structures, school choice), and non-cognitive student characteristics such as academic expectations, reading habits, and school belonging. However, classroom-level processes and family academic support remain comparatively underexplored, representing an important avenue for future research.

School segregation has emerged as a particularly active area of study attracting growing institutional attention. As with other equity dimensions, consensus on measurement remains limited, particularly for socioeconomic segregation. The SI index is increasingly recognized as the most appropriate indicator due to its compatibility with the scalar nature of SES measures in ILSAs (Murillo, 2016), a conclusion reinforced by previous reviews (Enchikova et al., 2024) and supranational institutions such as the OECD (2019) and the European Commission (Holmlund & Öckert, 2021). However, its empirical application remains limited compared to other dichotomous indices. Strong evidence consistently links educational marketization to higher levels of school segregation (Alegre & Ferrer, 2010; Perry et al., 2024), underscoring the risks of applying market-oriented logics to education systems. Importantly, no studies in the reviewed sample examine the relationship between school segregation, non-cognitive development, and classroom instructional processes, suggesting a promising direction for future research.

Greater methodological convergence was observed in the measurement of equality of opportunity, particularly through correlational approaches. Nevertheless, substantial variability exists in statistical techniques, with most studies using SES as a predictor and student achievement as the outcome variable within regression models, with analyses of the corresponding beta coefficients. Alternative approaches employ coefficients of determination (R^2) to assess the strength of SES-achievement relationships. In any case, studies analyzing trends in this indicator agree that there has been an increase in levels of inequality of opportunity, especially in the last 15 years (Duggan et al., 2023; Rupérez et al., 2018). Factors associated with inequality of opportunity are predominantly contextual and include, notably, those related to marketization policies, household and school resource availability, and the allocation of public education spending. The reviewed studies more frequently operationalize inequalities in terms of migrant or immigrant background than in terms of direct measures of race or ethnicity, reflecting the variables commonly available in



major ILSAs. Among educational factors, teaching quality has been consistently identified as a key protective variable, alongside positive school climate and coexistence. Importantly, inequality of opportunity appears to be increasing in several highly developed education systems characterized by more neoliberal educational and social policies, warranting further exploration of the compensatory policy measures implemented in some contexts to mitigate these effects.

Finally, although exploratory analyses describing equity levels and trends are abundant, predictive research examining causal or associative mechanisms remains relatively scarce. One limitation of this review is that the final sample represents a relatively small proportion of the initially identified literature due to the application of strict inclusion and quality criteria. While the literature offers detailed knowledge on segregation patterns, inequalities of outcomes, and SES effects on achievement, there is far less evidence on the factors capable of effectively reducing inequities. Future research should therefore prioritize two key areas: (1) identifying educational policies, practices, and school-level factors that promote equity and reduce segregation; and (2) examining the educational consequences of inequity across systems and populations. In this sense, given the impossibility of defining experimental designs to study these causal effects, the incorporation of causal inference techniques (Rutkowski & Delandshere, 2016), such as propensity score matching (Blanco-Varela et al., 2024) or difference-in-differences (Brinkmann et al., 2024; Strello et al., 2022), is highly recommended.

In line with Ferreira and Gignoux (2014), advancing understanding of the mechanisms underlying educational achievement and equity will provide the scientific basis necessary to inform education policy design aimed at improving learning outcomes and reducing educational inequalities.

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Author contributions

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Fernando Martínez-Abad: conceptualization, funding acquisition, investigation (50%), methodology, project administration, supervision, writing – review & editing

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Data availability statement

The screening database and data extraction matrix supporting this systematic review are openly available in Zenodo: <https://doi.org/10.5281/zenodo.20727844>



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