

Gendered Performance Inequities Rooted in Assessment Design and Educational Climate in Vocational and Technical Education

Siti Sahara, Yoyoh Jubaedah*, Tutin Aryanti, Iwa Kuntadi

Universitas Pendidikan Indonesia, Bandung, Indonesia

*Corresponding Email: tutin@upi.edu

ARTICLE INFO

Article history

Received: Dec 29, 2025

Revised: May 29, 2026

Accepted: May 31, 2026

Keywords

Structural Assessment Design
Educational Climate
Test Anxiety
Self-Efficacy Dynamics
Certification and Accreditation
Systems

ABSTRACT

Gender-neutral assessment and evaluation procedures may contribute to gender disparities in vocational and technical education (VTE). Previous research has largely examined these issues separately, limiting understanding of their interrelationships. This study systematically reviewed the manifestations and sources of gender bias in VTE assessment and evaluation. Following PRISMA 2020 guidelines, literature published between 2023 and 2025 was retrieved from Scopus, Taylor & Francis Online, IEEE Xplore, and ScienceDirect. A total of 68 eligible studies were analyzed using quality appraisal, bibliometric mapping with VOSviewer, and thematic synthesis. The review identified five interconnected forms of bias: structural assessment design, educational climate, certification and accreditation, competency assessment, and pedagogical framework bias. These biases arise from the interaction of psychological factors, including test anxiety, stereotype threat, and self-efficacy, instructional design features such as high-stakes timed assessments and restrictive rubrics, and institutional assessment policies. The findings indicate that gender bias results from complex, multi-level interactions rather than isolated factors.

This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Introduction

The gender disparity in vocational education constitutes a serious obstacle, rooted in assessment and evaluation methodologies, and substantially perpetuates ongoing inequities (Beroíza-Valenzuela & Salas-Guzmán, 2024; Sarabi & Smith, 2023). Gender-based discrimination perpetuates cultural preconceptions that systematically diminish assessments of women's abilities in male-dominated technical domains (Andersen, 2023; Khokhlova et al., 2023). Although the contribution of women in higher education is increasingly recognized, their better academic success has not yet translated into employment results or an improved quality of life. This disparity is most pronounced in South Asia, the Middle East, and North Africa, where the percentages of women's engagement in the labor force are about 26% and 20%, respectively. These numbers are far lower than other regions like Latin America ($\pm 47\%$) and East Asia ($\pm 41\%$) (World Bank Group, 2025). The disparity in workforce participation rates across the world is enormous, as shown in Figure 1 below:

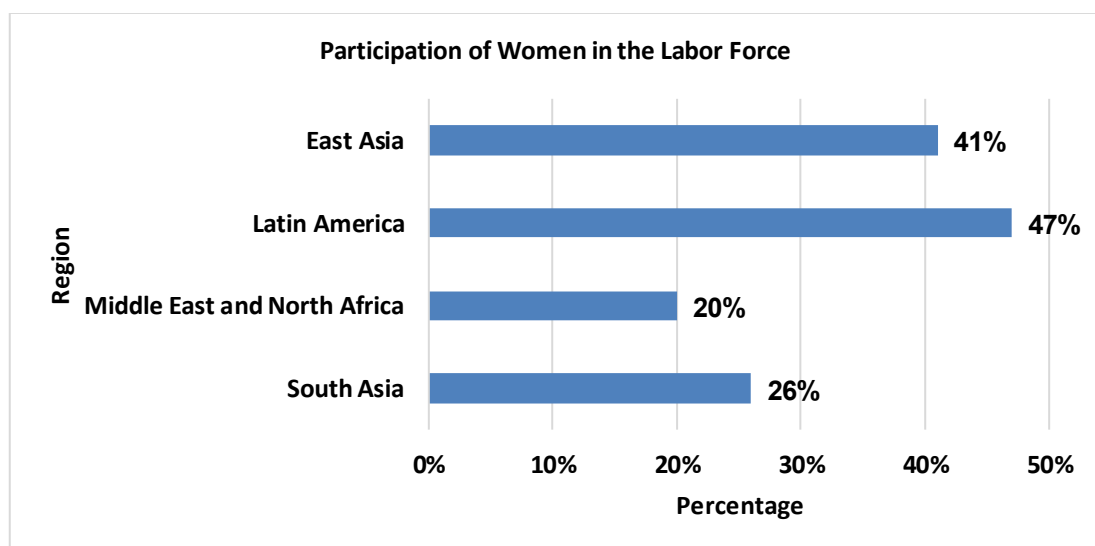


Fig 1: Participation of Women in the Labor Force
Source : World Bank Group 2025

This situation highlights the necessity of comprehending and tackling the systemic obstacles that impede women's complete engagement in professional development opportunities, especially the convergence of gender bias and evaluation methods, manifested as detrimental institutional discrimination. Assessment techniques profoundly influence academic paths, professional goals, and sustained engagement in vocational education disciplines (Aragón et al., 2023; Lamba et al., 2023). Current studies on gender bias in vocational education assessments indicate disjointed but

troubling patterns of discrimination evident across multiple educational tiers and evaluative settings. Bibliometric analysis facilitates the discovery of significant research clusters, knowledge deficiencies, and emerging trends that standard narrative synthesis cannot elucidate (Gao et al., 2022; Samsul et al., 2023). Bibliometric analysis elucidates the interconnections among theoretical frameworks, methodological approaches, and empirical findings, which can be visualized to uncover previously unrecognized relationships and facilitate new avenues for theoretical integration (Kaushal et al., 2023; You et al., 2024). The mapping approach is essential for comprehending the relationships between gender bias studies in assessment and overarching issues, including educational fairness, diversity and inclusion initiatives, and institutional reforms in vocational education McGrath and Yamada (2023).

. The main objective of this vocational education research review is to comprehensively analyze the existing literature on gender bias in assessment and evaluation practices in vocational and technical education. The analysis focuses on how biased evaluation methods contribute to gaps in academic performance, retention rates, and career trajectories. The review process will use strict inclusion and exclusion criteria to ensure the quality of the selected primary studies, as well as utilize an established bias assessment framework to evaluate the methodological quality and reliability of the research findings. Based on these objectives, this research is designed to answer the following research questions:

1. RQ1: What are the predominant manifestations of gender bias observed in the assessment and evaluation techniques utilized in vocational and technical education?
2. RQ2: What features contribute to gender bias in the assessment and evaluation methodologies employed in vocational and technical education?

Method

This research is structured based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure transparency, completeness, and methodological rigor in the review process Page et al (2021). The article search process includes research objectives, inclusion and exclusion criteria, search strategies, data extraction procedures, and a quality assessment framework to maintain methodological transparency and enable the discovery of new theories Yim et al (2024). A comprehensive search strategy is designed to identify all relevant studies examining gender bias in assessment and evaluation within the context of vocational and technical education. Database searches were conducted systematically to ensure

comprehensive literature coverage, including Scopus, Taylor & Francis Online, IEEE Xplore, and ScienceDirect Lee and Chen (2025).

The search strategy combines free keywords with Boolean operators to maximize sensitivity while maintaining specificity. The main search string is as follows:

((("gender bias" OR "gender inequality" OR "gender gap" OR "gender difference*" OR "gender disparity" OR "gender stereotype*" OR "sex bias" OR "sex difference*") AND ("assessment" OR "evaluation" OR "testing" OR "examination" OR "grading" OR "measurement" OR "scoring" OR "performance evaluation") AND ("STEM" OR "science education" OR "technology education" OR "engineering education" OR "mathematics education" OR "technical education" OR "vocational education" OR "science learning" OR "mathematical learning")))).

The exclusion criteria utilized in the PRISMA 2020 screening procedure are encapsulated in Table 1. The criteria delineate the rationale for article exclusion during the identification, screening, retrieval, and eligibility phases, whereas the quality assessment of the studies occurs subsequent to the articles satisfying the eligibility requirements. Quality Criteria explain in Table 1.

Table 1. Quality Criteria

<i>PRISMA Stage</i>	<i>Categories in Figure 2</i>	<i>Number</i>	<i>Explicit exclusion criteria</i>
Identification	Records marked as ineligible by automation tools	562	Articles were excluded because they fell outside the initial search parameters, did not meet the publication year limits, did not meet the language or document type criteria, or had incomplete basic metadata.
Screening	Records excluded	84	Articles were excluded because the title and abstract did not indicate a clear focus on vocational or technical education, gender issues, or assessment / evaluation.
Retrieval	Reports not retrieved	79	Articles were excluded because the full text could not be obtained through institutional databases, publisher platforms, or open access sources.
Eligibility	Reports excluded	13	Articles were excluded because the educational context did not align with the focus of vocational education, technical education, STEM-related technical training, or comparable skills-based learning contexts.
Eligibility	Reports excluded	11	Articles were excluded for not providing sufficient methodological details, such as information about the research design, participants, data collection procedures, or data analysis.
Eligibility	Reports excluded	7	Articles were excluded for not providing extractable evidence regarding gender-based assessment / evaluation, score differences, testing bias, or competency measurement.
Eligibility	Reports excluded	5	Articles were excluded because they did not directly align with the research questions in this review.

The synthesis process in this research is carried out while maintaining sensitivity to various contextual factors, including education level, vocational education discipline, cultural context, and the type of assessment used. This effort aims to identify factors that may potentially moderate the relationship between gender bias and educational outcomes. This research uses a bibliometric analysis and content analysis approach to explore, identify, and present a synthesis of the literature related to gender bias in assessment and evaluation methods in vocational and technical education. Bibliometric analysis was conducted through co-citation mapping using the VOSviewer software.

The outcomes of the bibliometric analysis conducted by VOSviewer serve as the foundation for subsequent qualitative analysis. The abstracts of the chosen papers are meticulously examined to confirm their correspondence with the established clusters. The analysis illustrates general patterns in influential publications, including frequently cited references, related research disciplines, authors, journals, and institutions that significantly contribute to this field. Following the evaluation of the precision of gender analysis and policy contributions, the total number of studies was refined to 68 final selections considered most pertinent, high-quality, and influential for the creation of a thorough literature review, as well as for advancing the comprehension and evolution of more gender-equitable assessment practices in vocational and technical education, as illustrated in Figure 2.

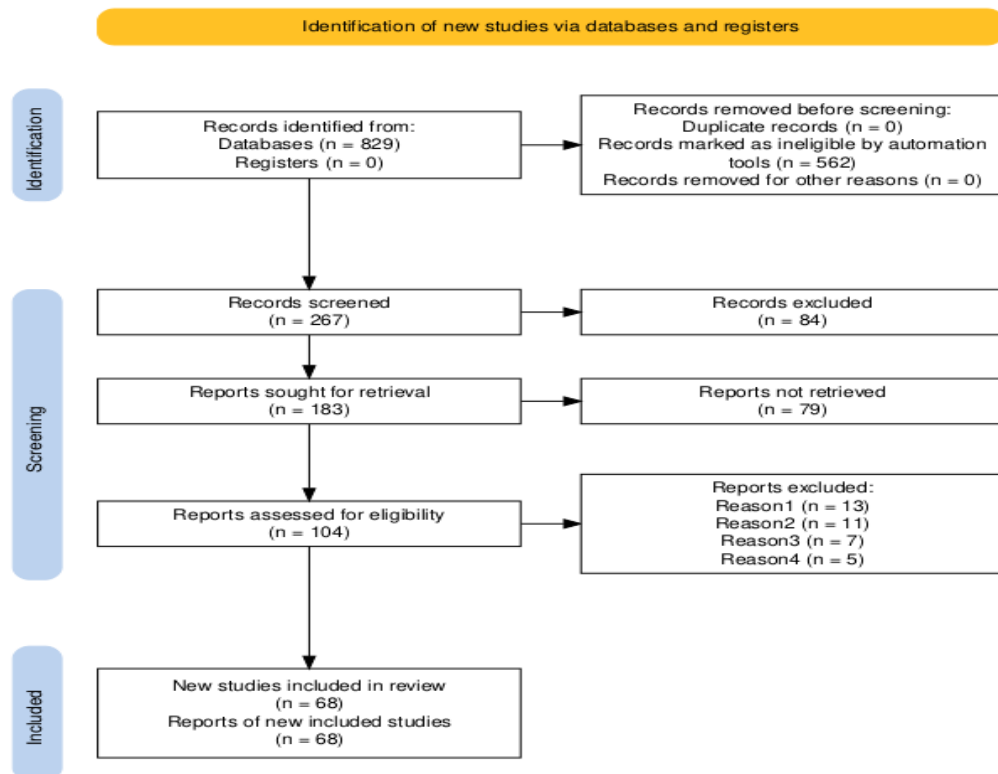


Fig 2: Diagram PRISMA

Result

Gender bias in assessment and evaluation methods in education has evolved into a comprehensive and multidimensional field of research. A bibliometric analysis of 68 relevant studies reveals that this issue has become a global focus, with contributions from 27 countries across various continents. The development of that landscape shows a systematic evolution from descriptive understanding to implementable solutions. This development simultaneously reflects the academic and practical urgency in creating a fair and inclusive vocational education assessment system. Figure 3 shows a significant concentration of research on gender bias in assessment methods in North America and Europe.

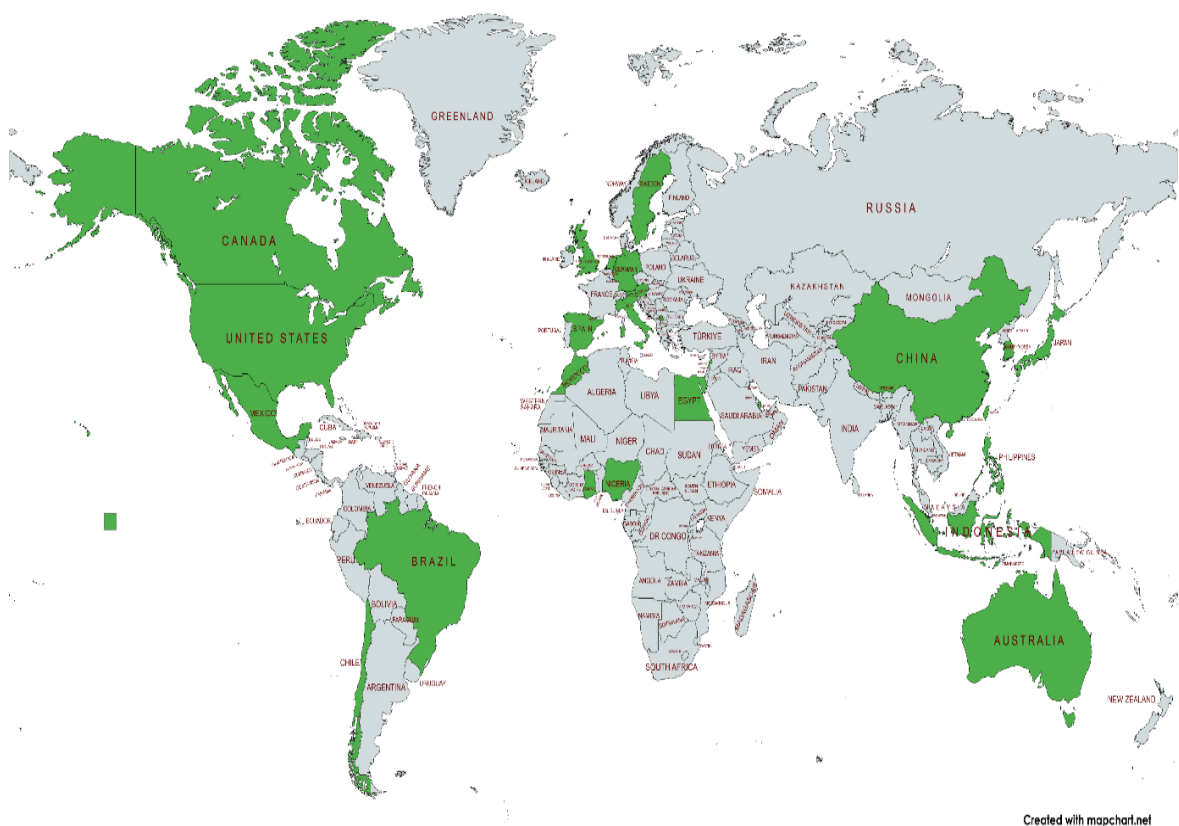


Fig 3: Geographic Mapping of Publications on Gender Bias in Assessment and Evaluation in Vocational and Technical Education

Spain leads with 13 publications (19.1%), followed by Germany with 8 publications (11.8%) and the United States with 7 publications (10.3%). Europe collectively accounts for 41.2% of publications, indicating a robust dedication to gender equality in education. North America accounts for 11.8% of papers, predominantly concentrating on performance assessment and learning

outcomes. The Asia-Pacific area accounts for 13.2%, predominantly due to research from Indonesia, the Philippines, China, Japan, and South Korea, highlighting the incorporation of cultural viewpoints in bias evaluation studies. Africa accounts for 4.4% of publications, a modest figure that underscores the emphasis on access and participation in vocational and technical education. The global geographical distribution indicates that gender bias in assessment has emerged as a subject of international academic discourse.

Network visualization using VOSviewer on the bibliometric map of gender bias in assessment methods in vocational and technical education in Figure 4 shows three main clusters with complementary connections. The green cluster (Gender Differences & Assessment) emerges as the dominant cluster, highlighting a concentration of research on gender differences, academic performance, mathematics, self-efficacy, and educational assessment. This focus reflects academic attention to how implicit gender stereotypes affect the evaluation of cognitive abilities and academic performance of students in the field of vocational education. The blue cluster (Demographics & Educational Levels) emphasizes the segmentation of research based on educational levels, ranging from primary education and middle school to higher education, as well as demographic characteristics such as female, male, and students. This pattern aligns with findings that gender bias in the assessment of vocational and technical education consistently emerges from primary school to higher education levels Meoli et al (2024).

The purple cluster (Psychology & Implicit Bias) emphasizes psychological factors, including psychology, self-efficacy, anxiety, and competencies, which interact with the other two clusters and assert that gender bias in vocational and technical education assessments is not only academically objective but also influenced by psychological aspects and students' self-perception. The entire network of concepts illustrates the multidimensional complexity of gender bias in vocational and technical education assessment practices. Academic, psychological, and socio-gender dimensions interact with each other in shaping the vocational education evaluation ecosystem, which requires a holistic approach so that the assessment system can become more inclusive and free of bias. Mapping Gender Bias In Vocational And Technical Education Assessments Using VOSviewer explain in Figure 4.

The bibliometric mapping results obtained by VOSviewer visualize the associations among keywords and reinforce the analytical basis for thematic synthesis in this study. The correlation among the clusters of Gender Differences & Assessment, Demographics & Educational Levels, and Psychology & Implicit Bias suggests that gender bias in assessment transcends a mere technical

concern of evaluation. Bias is established by the interplay of evaluation design, student attributes, educational levels, and psychological factors that affect learning experiences and academic outcomes.

Fig 4: Mapping Gender Bias In Vocational And Technical Education Assessments Using VOSviewer.

RQ1 : What are the predominant manifestations of gender bias observed in the assessment and evaluation techniques utilized in vocational and technical education?

Categories of Gender Bias in Assessment and Evaluation Practices Applied in Vocational and Technical Education

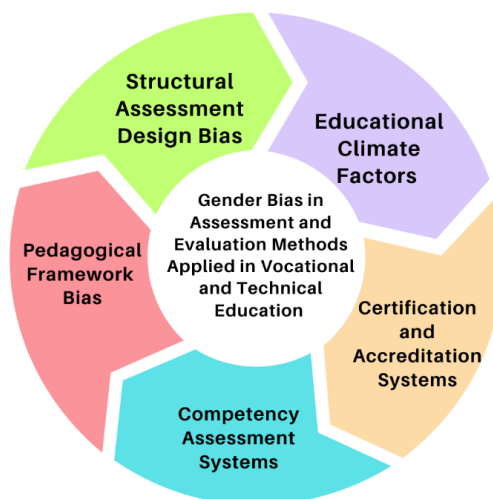


Fig 5: Gender Bias Categories in Assessment and Evaluation Practices Applied in Vocational and Technical Education

1. Structural Assessment Design Bias

The most systematic manifestation of gender discrimination in the administration of vocational and technical education is structural evaluation design bias. This bias is the result of the subjective judgments of evaluators and the inherent framework of the vocational education assessment and evaluation system that institutions employ (Harjono et al., 2025; Lennon-Maslin et al., 2023). Despite the existence of gender disparities in cognitive strategies, emotional regulation, and demonstrations of competence, assessment instruments, testing formats, evaluation rubrics, and procedures are frequently developed under the assumption that all learners respond uniformly to evaluative contexts (Morselli, 2024; Palobo et al., 2025). This circumstance, inherently, distorts the evaluation system in favor of specific cognitive strategies and emotional regulation that are typically associated with males, while disregarding the diverse methods through which women demonstrate knowledge and skills Kemper and Renold (2024).

The most apparent form of bias is seen in the use of high-stakes tests based on short timeframes that pressure participants with high levels of anxiety, a condition that is consistently more experienced by women, potentially lowering their performance in standardized assessments Wright (2025). In the rubric for vocational and technical education practicals, assessments tend to emphasize speed and technical accuracy, which leads to the underappreciation of creativity and conceptual understanding that are generally more prominent in women (Farrar et al., 2023; Hyseni Duraku et al., 2023). On the other hand, although teams led by women have been proven to generate

more innovative and disruptive ideas, the scientific impact they receive is often still considered lower compared to male-led teams (Abdurrahman et al., 2022; Yang et al., 2024). This situation shows that structural bias operates subtly yet has a widespread impact in reinforcing the gap in academic and professional achievements of women in vocational and technical education Choi et al (2023).

2. Educational Climate Factors

Educational climate factors represent the overall academic atmosphere formed by institutional policies, evaluation practices, social norms, and interaction patterns that occur in vocational and technical education. This educational climate plays an important role in determining how assessment methods are perceived by students and to what extent the results truly reflect the competencies possessed Farrar et al (2023). The gender bias that emerges in the assessment process is not solely caused by the individual attitudes of the assessors but is also embedded in the evaluation structures and cultures that are institutionally prevalent Yang et al (2024). Social and cultural norms inherent in the field of vocational and technical education also reinforce evaluative bias.

Gender stereotypes, such as the assumption that technical skills are more associated with men, drive a process of evaluation that is not entirely objective toward women's contributions Harnischfeger and Stahl (2025). This pattern is clearly visible in collaboration-based evaluations or group work, where male contributions tend to be recognized more quickly, while female contributions are often downplayed or even overlooked Morsi and Assem (2024). The institutional climate built through uniform assessment and certification standards often does not consider the need for an inclusive assessment approach Freeman et al (2024). This results in an academic atmosphere shaped by formal policies, social norms, and daily interactions that ultimately reinforce inequalities in recognition and academic achievement Epifanio and Calvo-Iglesias (2024). Therefore, gender bias in the assessment of vocational and technical education cannot be understood as an individual phenomenon but rather as a consequence of an educational climate that is not yet fully sensitive to gender diversity.

3. Certification and Accreditation Systems

Certification and accreditation systems are two main instruments in ensuring the quality of vocational and technical education, but both are not entirely free from gender bias in the assessment and evaluation processes. Certification systems typically focus on measuring individual competence

through standardized tests, time-based tests, or practical skill demonstrations. Instruments like these often represent a form of gender bias because they prioritize competitive cognitive styles, technical speed, and procedural accuracy, which are culturally more associated with men (Hyseni Duraku et al., 2023; Lennon-Maslin et al., 2023; Lennon-Maslin and Quaiser-Pohl, 2024; Wright, 2025). Women who tend to show strengths in aspects of collaboration, in-depth analysis, and creativity are actually less recognized in the certification model (Bangga-Modesto, 2024; Palobo et al., 2025). This condition makes certification potentially widen the gap in academic and professional achievements, even though the actual skill levels between men and women are relatively equal Freeman et al (2024).

Accreditation systems operate at the institutional and program levels, assessing the quality of educational delivery based on specific quality standards. Gender bias in the context of accreditation arises when the indicators used place too much emphasis on quantitative achievements, such as the number of graduates, on-time graduation rates, or technical publication outputs Kumar et al (2022). Important dimensions related to women's retention, inclusive learning experiences, and non-discrimination policies are often not used as assessment benchmarks (Farrar et al., 2023; Frade-Martínez et al., 2024; Yang et al., 2024). This situation is exacerbated by the male-dominated composition of accreditation panels, making it rare for gender-inclusive perspectives to be reflected in evaluations (Epifanio and Calvo-Iglesias, 2024; Morgan, 2024). The absence of a requirement to report gender-disaggregated data often hides the gaps experienced by women in vocational and technical education behind aggregate figures (Maisano et al., 2024; Morsi and Assem, 2024). Certification and accreditation are interconnected in perpetuating structural bias. The certification process in vocational education produces graduates who are evaluated with instruments that are not gender-sensitive, while vocational education accreditation evaluates institutions without explicitly considering the dimension of gender equality.

4. Competency Assessment Systems

Competency assessment systems are evaluative frameworks that prioritize the exhibition of abilities, knowledge, and attitudes in accordance with established standards in vocational and technical education. This approach is typically implemented via practical examinations, job simulations, portfolios, competency certifications, or performance-based evaluations aligned with industry and professional norms Chakraborty et al (2023). The primary focus of this vocational education is to guarantee that graduates have skills applicable in the actual workforce Mansour et al (2024). Gender bias in competency assessment systems frequently emerges from the

development of competency indicators that lack complete gender neutrality. The standards employed remain predominantly derived from traditional industrial models influenced by masculine viewpoints, resulting in the marginalization of contextual, reflective, or alternative strategy-oriented dimensions of competence (Epifanio and Calvo-Iglesias, 2024). This circumstance leads to the insufficient accommodation of the diverse learning styles and skill presentation methods, predominantly demonstrated by women, within the vocational education evaluation framework Cuder et al (2024).

In practical assessments, evaluation heavily relies on the assessor's perception of the participant's performance. Although designed as an objective instrument, evaluation is often influenced by the assessor's expectations or preferences regarding certain task completion styles. For example, a systematic problem-solving strategy that takes longer may be rated as less efficient, even though the quality of the results achieved is equivalent or even better (Herrero-Álvarez et al., 2024). Another limitation lies in the consistency of assessments among evaluators. The same assessed competency can yield different scores due to variations in rubric interpretation. This situation allows for the subtle operation of gender bias, as the subjective tendencies of assessors influence the final decision Pont-Niclòs et al (2024). These conditions indicate that competency assessment systems are not yet fully free from the potential bias that affects the validity and reliability of the assessments.

5. Pedagogical Framework Bias

Pedagogical framework prejudice constitutes a type of gender bias ingrained in the structure of learning and assessment frameworks within vocational and technical education. This bias emerges when the concept of academic achievement is constructed using limited metrics, thereby overlooking the variety of learning methodologies and student experiences (Epifanio and Calvo-Iglesias, 2024; Yang et al., 2024). This bias originates not just from the assessment tools or the assessors' preferences but is also entrenched in the curricular framework and instructional methodologies that underpin the evaluation process Lennon-Maslin et al (2023). This prejudice manifests when the evaluation methodology fails to consider the social, psychological, and experiential factors that may uniquely impact female pupils.

Bias in occupational testing is evident within the educational framework when evaluation models constrain the definition of competence, particularly through metrics like speed, technical precision, and individual job performance Iliescu et al (2025). Students are frequently evaluated on the effectiveness of their methodologies and the conformity of the final output to technical standards

during automotive practice assessments Rausch et al (2024). Diagnostic reasoning, workplace safety awareness, process documentation, collaborative problem-solving, tool preparation, communication with colleagues or supervisors, and the capacity to offer reflective justifications for technical decisions are essential components of vocational competence that may be overlooked by such rubrics (Chen et al., 2024; Villarroel et al., 2024).

These conditions may disadvantage students who demonstrate competence by systematic preparation, comprehensive analysis, collaborative structuring, or conceptual clarification (De Vos et al., 2024; Sandal, 2023). Students demonstrating poor work patterns are prone to receiving lesser grades than their more expedient peers, despite comparable work quality Zanga and De Gioannis (2023). This situation demonstrates that bias arises not solely from the evaluator's judgment but is also embedded within the educational system that determines which competencies are recognized, evaluated, and valued in occupational assessments Meijer et al (2025).

Gender-based stereotype pressure, disproportionate role expectations, and dual academic-social burdens often shape how female students engage with learning materials and demonstrate competence (Farrar et al., 2023; Harnischfeger and Stahl, 2025). However, rigid and insufficiently adaptive pedagogical frameworks limit opportunities for differentiated demonstration of learning, resulting in assessment outcomes that frequently misrepresent students' actual capabilities (Malespina et al., 2024). Such misalignment produces artificial performance disparities and reinforces deficit-oriented narratives that position women as less capable in technical domains (Zúñiga-Mejías & Huincahue, 2024). Over time, pedagogical framework bias not only suppresses women's participation and persistence in vocational and technical education pathways but also constrains their academic progression and long-term professional mobility.

RQ2: What features contribute to gender bias in the assessment and evaluation methodologies employed in vocational and technical education?

The results of a systematic analysis of 68 studies show that gender bias in assessment and evaluation methods in vocational and technical education does not only stem from individual factors but is also embedded in structural, pedagogical, and institutional dimensions. Psychological factors such as test anxiety and gender stereotypes interact with the design of evaluation instruments, which often emphasize speed, technical objectivity, and individual competition, thereby creating greater barriers for women. On the other hand, institutional factors such as the academic climate, social norms, and curriculum construction also reinforce bias by framing performance expectations that are more aligned with masculine learning styles. This condition indicates that evaluative bias

does not stand alone but is formed through a complex combination of personal characteristics, assessment instrument design, and the institutional context in which the evaluation takes place, as shown in the following Figure 6.

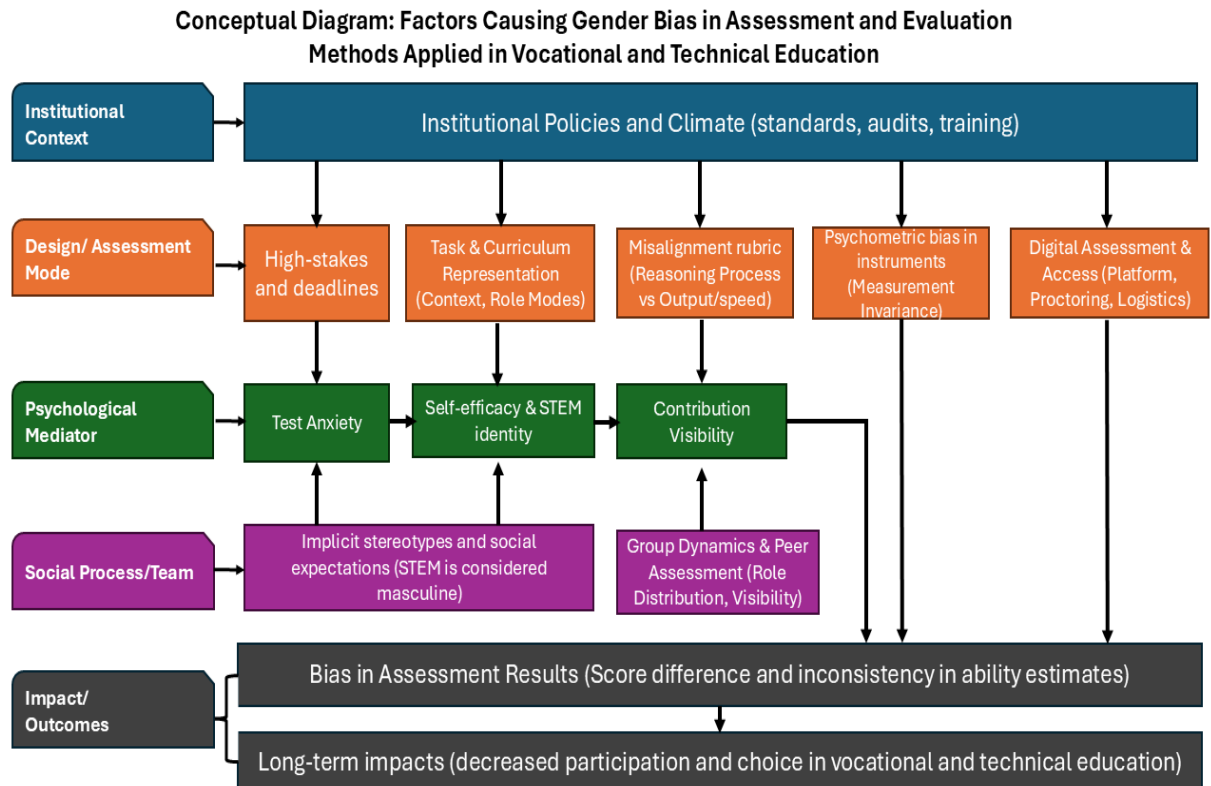


Fig. 6: Conceptual Diagram: Factors Causing Gender Bias in Assessment and Evaluation Methods Applied in Vocational and Technical Education

Strict time limits and the intense pressure of the assessment procedure were found to be significant bias triggers because they raised test anxiety, which had varying effects on student performance. According to an analysis of science courses, men are generally more stable under time pressure and process, while women experience higher levels of anxiety and perform worse on tests. This tendency diminishes expectations for vocational and technical education and lowers success, resulting in bias that is evaluated not just by test results but also by long-term academic decisions like choosing a study path. Due to unequal exposure and confidence development from the start of the assessment process, math anxiety and self-efficacy toward vocational and technical education choices have been shown to contribute to the assessment outcome gap at the secondary school level (Cuder et al., 2024; Malespina et al., 2024).

The intense pressure of the assessment process and stringent time limitations appeared as significant catalysts for bias, as they heightened test anxiety, which variably affected student performance. Analysis of science courses indicates that women experience greater anxiety and achieve poorer exam scores, whereas men generally exhibit more stability under time constraints and throughout processing. This tendency diminishes achievement and undermines desires for vocational and technical education, resulting in bias that is reflected not just in test scores but also in long-term academic choices, such as the choosing of study paths. At the secondary school level, a correlation exists between math anxiety and self-efficacy regarding vocational and technical education choices, which intensifies the disparity in assessment outcomes due to the uneven development of exposure and confidence from the outset of the assessment process (Morgan, 2024; Zúñiga-Mejías and Huincahue, 2024).

The dynamics of collaborative work and peer assessment introduce biases when the allocation of roles, decision-making processes, and visibility of contributions are inequitable. Mixed-gender teams frequently demonstrate a lack of recognition for women's contributions, leading to group project evaluations and peer assessments that fail to effectively represent true capabilities Yasdin et al (2025). Collaboration quality improves when grouping, role training, and participation rules are intentionally gendered; however, this enhancement is frequently diminished by rubrics that emphasize technical output and execution speed over reasoning processes, design argumentation, and team coordination Karmaeva and Ilieva-Trichkova (2024). According to current research, the application of gender-perspective challenge-based learning (CBL) can enhance process and product evaluations, suggesting that bias originates from the misalignment of assessment rubrics with varied contributions (Huesca et al., 2024; Kube, Gombert, et al., 2024; Morsi and Assem, 2024).

Assessment methods based on digital platforms additionally create novel biases due to inequalities in device accessibility, connection reliability, technological proficiency, and proctoring techniques, which do not uniformly affect genders Zervas and Stiakakis (2024). Technical obstacles and logistical challenges hinder quiz performance at specific intervals, along with assignment submissions and high-stakes online examinations, resulting in ratings that reflect factors outside competence. Creating computational tasks that adhere to binary preferences also influences performance disparities, which indicate the appropriateness of the interaction style rather than the real aptitude for computational thinking Setiyawan et al (2025). The likelihood of psychometric bias escalates when vocational education readiness and design thinking instruments lack testing for measurement invariance across genders and multigroup validation, which is essential for ensuring

that scores accurately reflect the same construct across diverse population groups (Lukitasari et al., 2025; Maisano et al., 2024; Niousha et al., 2023).

The climate and institutional policies shape all evaluation procedures via internal standards, quality mechanisms, and equity agendas. Institutions that incorporate gender equality concepts into policies, faculty training, assessment rubric evaluations, and achievement tracking demonstrate a decrease in bias in project-based assessments and standardized examinations. The collaboration of affirmative actions, enhanced curriculum representation, and transparent evaluation governance can establish a more equitable vocational education assessment system. In that ecosystem, intellectual, collaborative, and creative contributions are valued similarly to technical skills, hence sustainably diminishing differences in academic performance Epifanio and Calvo-Iglesias (2024).

Result and Discussion

RQ1 : What are the predominant manifestations of gender bias observed in the assessment and evaluation techniques utilized in vocational and technical education?

The summary demonstrates that gender bias in the assessment of vocational education is layered and systematic rather than the result of a collection of evaluators' personal biases. The assumption that students' responses are uniform, although gender differences exist in cognitive techniques, emotional control, and methods of exhibiting competence, is the source of bias in structure assessment design Griselda (2024). Through test anxiety and psychometric friction, the emphasis on quick execution, high-stakes formats, and short-term memory in assessments lowers women's performance, leading to scores that are less indicative of the synthetic and constructive skills necessary for long-term success. While the macho narrative about success markers in technical disciplines is strengthened, the representation of women's accomplishments is weakened, according to the consistent cross-study findings. Everyday evaluation procedures are always framed by the educational environment in which the instrument is utilized, so the impact of design does not occur in isolation (Rozgonjuk et al., 2024; Vlachopoulos and Makri, 2024).

Educational climate factors indicate that bias does not stem solely from the instrument but is supported by evaluation norms and culture at the classroom, program, and institutional levels. The stereotype of technical competence associated with men influences perceptions of contribution in collaborative projects, leading to the invisibility of women's contributions and disproportionate deviations in evaluation compared to the quality of work results (Beroíza-Valenzuela, 2025; Heilman et al., 2024). This climate normalizes bias and promotes less accommodating evaluation

standards for diverse contributions, including design argumentation, coordination, and creativity, which are difficult to capture in short tests. Experimental evidence also shows different feedback patterns, where boys are more often praised for innate ability, while girls receive feedback about effort and persistence Copur-Gencturk et al (2023).

Certification and accreditation systems generate a dual bias at both the individual and institutional levels. Short-term, assessment-oriented certifications or technical exhibitions emphasize specific cognitive domains, while accreditation metrics primarily focus on quantitative outcomes, often lacking clear standards for gender equality Holden and Tanenbaum (2023). This combination creates a notable blind spot, since graduates are assessed using tools that lack gender sensitivity, while institutions receive accreditation without adequate evidence showing that their evaluation procedures are equitable across genders. Some studies suggest a positive bias towards women in certain certification examinations; however, these findings do not consider the systemic bias inherent in the entire design and implementation of the assessments Owen et al (2025) This collection of indicators eventually permeated the realm of competency assessment in educational environments and vocational training.

Competency assessment systems exhibit implicit biases due to indicators that conform to prevailing industry standards, performance evaluation methods dependent on assessor interpretation, and inconsistencies among assessors in rubric implementation. Systematic yet slower resolution procedures are frequently considered less efficient, irrespective of the quality of the solutions attained, rendering assessment scores susceptible to the influence of non-gender-neutral work style preferences Shanks et al (2024). Psychometric instruments indicate a correlation between males and vocational education, whereas the validity and reliability of evaluations diminish when collaboration and thinking are not assessed on par with execution speed (Beroíza-Valenzuela, 2025; Liorens et al., 2021). This prejudice originates from the uniform definitions of academic success within curriculum and instructional practices.

Bias in pedagogical frameworks occurs when academic performance is measured by limited criteria, thereby undermining the diversity of learners' strategies and experiences Khokhlova et al (2023). The conflict between stringent curriculum requirements and the psychosocial factors affecting female students, including stereotypes and role expectations, results in a discrepancy between the skills prioritized by vocational education and assessment and those that foster innovation, creativity, and collaboration in contemporary vocational and technical education methodologies Kube et al (2024). The constraints of a less flexible framework perpetuate noticeable

performance disparities and intensify the attrition of female talent during the evaluation process. The causal relationship between instruments and the pedagogical framework necessitates concurrent rectification at the design, implementation, and quality governance stages.

RQ2: What features contribute to gender bias in the assessment and evaluation methodologies employed in vocational and technical education?

The causes of gender bias in assessment and evaluation in vocational and technical education are multidimensional. Individual factors, assessment design and conduct, and campus policies and culture all contribute to the impact. These three areas reinforce each other, resulting in differences in achievements between women and men. At the individual level, cognitive psychological factors play an important role. Anxiety toward mathematics and science, sensitivity to emotion regulation in evaluation situations, and cognitive load due to stereotype threat reduce performance, especially in high-stakes exams (Beroíza-Valenzuela, 2025; Justicia-Galiano et al., 2023). This condition is closely related to lower academic self-efficacy and a less strong identity as graduates of vocational and technical education, particularly among some women (Brage-del-Río et al., 2025; Head and Wilson, 2025). Study strategies leading up to exams, resilience in facing difficult tasks, and the interpretation of feedback all demonstrate the impact. As a result, bias not only appears in the scores at that moment but also shapes patterns of motivation and perseverance in learning over time Kim et al (2025).

At the instructional level, the design of instruments and assessment methods directly influences the emergence of gender bias in vocational and technical education. Strict timed exams encourage students to respond quickly, take high risks, and adapt to evaluation formats that emphasize speed over the depth of the thinking process Yan and Liu (2025). Such assessment patterns have the potential to reduce recognition of precision, creativity, conceptual argumentation, and collaborative problem-solving, which are also important components of vocational competence. Rubrics that overly emphasize technical precision and final results tend to overlook the learning process, task-solving strategies, and the various ways students demonstrate competence Griselda (2024). This condition shows that instructional bias does not only arise from the content of the assessment but also from the way competencies are defined, measured, and weighted in the evaluation system.

At the level of digital assessment, the expansion of online platform usage, proctoring systems, automated assessments, and adaptive devices introduces new sources of vulnerability to gender bias. The gap in access to devices, connection stability, technology literacy, and learning

environment conditions can affect students' performance in online quizzes, assignment submissions, and digital platform-based exams. Additionally, anxiety due to online proctoring and algorithmic bias in automated assessment systems can reproduce old patterns of bias in new forms, especially when the system design does not consider variations in responses, learning contexts, and access barriers experienced by different groups of learners (Baker and Hawn, 2022; Idowu et al., 2024). Thus, scores on digital assessments do not always purely represent academic or technical abilities, as they can be mixed with non-ability factors such as access to technology, surveillance pressure, and the compatibility of students with the platform design.

At the institutional and sociocultural levels, the campus climate, gender representation in leadership and teaching staff, and quality assurance policies play an important part in deciding whether evaluative bias will be reduced or instead reproduced. When assessment policies, course standards, and accreditation criteria do not explicitly incorporate a gender equality perspective, the different impacts of the assessment system on men and women tend to go undetected. Support such as mentoring, academic services, career guidance, rubric audits, and assessor training also needs to be equally available so that learners have the same opportunities to understand assessment standards and develop competencies (Bordieri et al., 2024; Erichsen et al., 2024). Therefore, reducing gender bias in vocational education evaluation requires planned institutional interventions, not just improvements at the assessment instrument level.

Conclusion

This study shows that gender bias in assessment and evaluation practices in vocational and technical education is systematic, multidimensional, and embedded in various interconnected layers of educational practices. The review results indicate that gender-based performance disparities do not stem from a single factor but are formed through the interaction between structural assessment design, educational climate, certification and accreditation systems, competency assessment systems, and biases within the pedagogical framework. The disparity becomes even more complex as it is reinforced by psychological factors, such as test anxiety, stereotype threat, and differences in self-efficacy. These layers of bias are also related to instructional factors, such as high-stakes tests with strict deadlines and narrow grading rubrics, as well as institutional factors, such as standardized evaluation policies, quality assurance mechanisms, and an academic culture that has not yet fully recognized differences in learning experiences and ways students demonstrate competence based on gender. The main contribution

of this review lies in the proposal of a more explicit and gender-responsive pedagogical assessment framework for vocational and technical education. This framework differs from conventional assessment models that have traditionally placed speed, technical precision, and individual performance as the main indicators of competence. As an alternative, vocational assessment needs to integrate authentic assessment, flexible competency-based rubrics, collaborative and reflective performance indicators, gender-sensitive feedback, and validation procedures that ensure assessment instruments measure the same construct fairly across different gender groups. That pedagogical orientation is important to ensure that conceptual reasoning, creativity, teamwork, problem-solving processes, and alternative ways of demonstrating competence receive recognition equivalent to technical execution.

Practically, these findings suggest that vocational institutions must reform their assessment processes via coordinated methods. The strategy encompasses the revision of assessment rubrics to mitigate implicit gender bias, the training of educators and evaluators in gender-sensitive assessment practices, the incorporation of gender equality metrics into certification and accreditation criteria, the monitoring of assessment outcomes via gender-disaggregated data, and the evaluation of digital assessment platforms for equity, accessibility, and measurement validity across diverse gender groups. The enhancement of this system enables assessments to serve not only as instruments for rating or certifying pupils but also as educational tools to broaden equitable learning possibilities. This study confirms that gender-responsive assessment reform is essential for improving equity, persistence, and career advancement in vocational and technical education. Prioritizing inclusive pedagogical design may transform assessment into a tool that enhances women's participation, acknowledges diverse competencies, and mitigates structural inequities in technical education paths. The paradigm presented in this study establishes a conceptual basis for future empirical research, the formulation of institutional policies, and the reconfiguration of evaluation systems aimed at fostering a more fair vocational education.

Acknowledgement

This research was funded by the Doctoral Dissertation Research Grant (PDD), a national competitive research grant administered by the Ministry of Higher Education, Science, and Technology, previously the Ministry of Education, Culture, Research, and Technology, through the Directorate of Research, Technology, and Community Service (DRTPM), under Decree No. 108/C3/DT.05.00/PL-MULTITAHUN LANJUTAN/2026 and Contract No. 468/UN40.F7/PT.01.01/2026.

References

- Abdurrahman, Parmin, & Muryanto, S. (2022). Evaluation on the automotive skill competency test through 'discontinuity' model and the competency test management of vocational education school in Central Java, Indonesia. *Heliyon*, 8(2), Article e08872. <https://doi.org/10.1016/j.heliyon.2022.e08872>
- Andersen, I. G. (2023). Teachers' gender bias in STEM: Results from a vignette study. *British Educational Research Journal*, 49(4), 833–851. <https://doi.org/10.1002/berj.3870>
- Aragón, O. R., Pietri, E. S., & Powell, B. A. (2023). Gender bias in teaching evaluations: The causal role of department gender composition. *Proceedings of the National Academy of Sciences*, 120(4), Article e2118466120. <https://doi.org/10.1073/pnas.2118466120>
- Baker, R. S., & Hawn, A. (2022). Algorithmic bias in education. *International Journal of Artificial Intelligence in Education*, 32(4), 1052–1092. <https://doi.org/10.1007/s40593-021-00285-9>
- Bangga-Modesto, D. (2024). Examining student perception on mobile augmented reality integration, gender differences, learning styles, feedback, challenges, and opportunities in an online physics class. *Science Education International*, 35(1), 1–12. <https://doi.org/10.33828/sei.v35.i1.1>
- Beroíza-Valenzuela, F. (2025). Implicit gender stereotypes in STEM: Measuring cognitive bias and group differences through reaction times. *International Journal of STEM Education*, 12(1), 1–15. <https://doi.org/10.1186/s40594-025-00541-7>
- Beroíza-Valenzuela, F., & Salas-Guzmán, N. (2024). STEM and gender gap: A systematic review in WoS, Scopus, and ERIC databases (2012–2022). *Frontiers in Education*, 9, Article 1378640. <https://doi.org/10.3389/feduc.2024.1378640>
- Bordieri, M. J., Waddill, P. J., Zhang, Q., McCarthy, M. L., Fuller, C., & Balthrop, D. (2024). Exploring the stability of the gender gap in faculty perceptions of gender climate at a rural regional university. *PLOS ONE*, 19(4), Article e0301285. <https://doi.org/10.1371/journal.pone.0301285>
- Brage-del-Río, M., Martin-Núñez, J. L., & Pablo-Lerchundi, I. (2025). Educational strategies to reduce the gender gap in the self-efficacy of high school students in STEM teaching. *Frontiers in Education*, 10, Article 1553001. <https://doi.org/10.3389/feduc.2025.1553001>
- Chakraborty, S., Gonzalez-Triana, Y., Mendoza, J., & Galatro, D. (2023). Insights on mapping Industry 4.0 and Education 4.0. *Frontiers in Education*, 8, Article 1150190. <https://doi.org/10.3389/feduc.2023.1150190>

- Chen, P., Goncharova, A., Li, J., & Frommberger, D. (2024). Competence-based approaches in curricula: A comparative analysis of Russian and Chinese commercial vocational education and training programmes. *Research in Comparative and International Education*, 19(1), 63–90. <https://doi.org/10.1177/17454999231219840>
- Choi, S., Li, H., & Ogawa, K. (2023). Upper secondary vocational education and decent work in Indonesia: A gender comparison. *International Journal of Educational Development*, 101, Article 102833. <https://doi.org/10.1016/j.ijedudev.2023.102833>
- Copur-Gencturk, Y., Thacker, I., & Cimpian, J. R. (2023). Teachers' race and gender biases and the moderating effects of their beliefs and dispositions. *International Journal of STEM Education*, 10(1), 1–25. <https://doi.org/10.1186/s40594-023-00420-z>
- Cuder, A., Pellizzoni, S., Di Marco, M., Blason, C., Doz, E., Giofrè, D., & Passolunghi, M. C. (2024). The impact of math anxiety and self-efficacy in middle school STEM choices: A 3-year longitudinal study. *British Journal of Educational Psychology*, 94(4), 1091–1108. <https://doi.org/10.1111/bjep.12707>
- De Vos, M. E., Baartman, L. K. J., Van der Vleuten, C. P. M., & De Bruijn, E. (2024). Unravelling workplace educators' judgment processes when assessing students' performance at the workplace. *Journal of Vocational Education & Training*, 76(3), 517–536. <https://doi.org/10.1080/13636820.2022.2042722>
- Epifanio, I., & Calvo-Iglesias, E. (2024). Actions for gender equality in scientific-technical areas in Spanish universities. *Educación XX1*, 27(2), 19–36. <https://doi.org/10.5944/educxx1.138279>
- Erichsen, K., Šaras, E. D., & Perez-Felkner, L. (2024). Toward institutional transformation: Warming the chilly climate for women in STEM through macrostructural change. *Frontiers in Education*, 9, Article 1328574. <https://doi.org/10.3389/feduc.2024.1328574>
- Farrar, V. S., Aguayo, B.-Y. C., & Caporale, N. (2023). Gendered performance gaps in an upper-division biology course: Academic, demographic, environmental, and affective factors. *CBE—Life Sciences Education*, 22(4), Article ar41. <https://doi.org/10.1187/cbe.23-03-0041>
- Frade-Martínez, C., Gamazo, A., & Olmos-Migueláñez, S. (2024). Evolution of contextual predictors of Spanish students' proficiency levels: A comparative study between PISA 2015 and 2018. *Revista de Investigación Educativa*, 42(2), 1–21. <https://doi.org/10.6018/rie.548151>
- Freeman, J. A., Gottfried, M. A., & Odle, T. K. (2024). Explaining course enrollment gaps in high school: Examination of gender-imbalance in the applied sciences. *Educational Policy*, 38(4), 897–936.

<https://doi.org/10.1177/08959048231174884>

- Gao, Y., Wong, S. L., Md. Khambari, M. N., & Noordin, N. (2022). A bibliometric analysis of online faculty professional development in higher education. *Research and Practice in Technology Enhanced Learning*, 17(1), Article 19. <https://doi.org/10.1186/s41039-022-00196-w>
- Griselda, S. (2024). Gender gap in standardized tests: What are we measuring? *Journal of Economic Behavior & Organization*, 221, 191–229. <https://doi.org/10.1016/j.jebo.2024.03.010>
- Harjono, Ramadhani, D. G., Haryani, S., Wicaksono, I., & Hestinasari, I. (2025). Self-assessment instrument for measuring employability skills in chemistry vocational school students: A case study on Volta cell material topics. *Science Talks*, 16, Article 100493. <https://doi.org/10.1016/j.sctalk.2025.100493>
- Harnischfeger, S., & Stahl, G. (2025). Studying Year 6 students' perceptions of gender and their engagement in STEM within an Australian primary school. *The Australian Educational Researcher*, 52(3), 2491–2510. <https://doi.org/10.1007/s13384-025-00821-9>
- Head, M., & Wilson, S. B. (2025). Identifying differences in STEM self-efficacy, sense of belonging, and STEM professional identity statuses among diverse learners. *Studies in Higher Education*, 1–18. <https://doi.org/10.1080/03075079.2025.2505927>
- Heilman, M. E., Caleo, S., & Manzi, F. (2024). Women at work: Pathways from gender stereotypes to gender bias and discrimination. *Annual Review of Organizational Psychology and Organizational Behavior*, 11(1), 165–192. <https://doi.org/10.1146/annurev-orgpsych-110721-034105>
- Herrero-Álvarez, R., León, C., Miranda, G., & Segredo, E. (2024). Training future engineers: Integrating Computational Thinking and effective learning methodologies into education. *Computer Applications in Engineering Education*, 32(3), Article e22723. <https://doi.org/10.1002/cae.22723>
- Holden, L. R., & Tanenbaum, G. J. (2023). Modern assessments of intelligence must be fair and equitable. *Journal of Intelligence*, 11(6), Article 126. <https://doi.org/10.3390/jintelligence11060126>
- Huesca, G., Rodríguez-Rosales, A., Lara-Prieto, V., Ruiz-Cantisani, M. I., & Acevedo, J. (2024). Effectiveness of Challenge-Based Learning in undergraduate engineering programs from competencies and gender perspectives. *Education Sciences*, 14(3), Article 255. <https://doi.org/10.3390/educsci14030255>
- Hyseni Duraku, Z., Konjufca, J., Hoxha, L., Blakaj, A., Bytyqi, B., Mjekiqi, E., & Bajgora, S. (2023).

- Reducing STEM test anxiety through classroom mindfulness training for lower secondary school children: A pilot study. *International Journal of Adolescence and Youth*, 28(1), Article 2242478. <https://doi.org/10.1080/02673843.2023.2242478>
- Idowu, J. A., Koshiyama, A. S., & Treleaven, P. (2024). Investigating algorithmic bias in student progress monitoring. *Computers and Education: Artificial Intelligence*, 7, Article 100267. <https://doi.org/10.1016/j.caeai.2024.100267>
- Iliescu, D., Greiff, S., & Ion, A. (2025). Evidence based approaches for enhancing vocational education worldwide. *npj Science of Learning*, 10(1), Article 5. <https://doi.org/10.1038/s41539-025-00317-2>
- Justicia-Galiano, M. J., Martín-Puga, M. E., Linares, R., & Pelegrina, S. (2023). Gender stereotypes about math anxiety: Ability and emotional components. *Learning and Individual Differences*, 105, Article 102316. <https://doi.org/10.1016/j.lindif.2023.102316>
- Karmaeva, N., & Ilieva-Trichkova, P. (2024). Class-based inequality and higher education achievement in Europe: The role of gender and class. *International Journal of Sociology and Social Policy*, 44(11/12), 974–990. <https://doi.org/10.1108/IJSSP-02-2024-0074>
- Kaushal, N., Kaurav, R. P. S., Sivathanu, B., & Kaushik, N. (2023). Artificial intelligence and HRM: Identifying future research agenda using systematic literature review and bibliometric analysis. *Management Review Quarterly*, 73(2), 455–493. <https://doi.org/10.1007/s11301-021-00249-2>
- Kemper, J., & Renold, U. (2024). Evaluating the impact of general versus vocational education on labor market outcomes in Egypt by means of a regression discontinuity design. *Journal of Development Economics*, 166, Article 103172. <https://doi.org/10.1016/j.jdeveco.2023.103172>
- Khokhlova, O., Lamba, N., & Kishore, S. (2023). Evaluating student evaluations: Evidence of gender bias against women in higher education based on perceived learning and instructor personality. *Frontiers in Education*, 8, Article 1158132. <https://doi.org/10.3389/feduc.2023.1158132>
- Kim, J., Hornburg, C. B., Grose, G. E., Levinson, T. G., & Fazio, L. K. (2025). Picturing mathematicians: Examining how gender and math anxiety relate to students' representations of mathematicians in late elementary and middle school. *Journal of Experimental Child Psychology*, 258, Article 106290. <https://doi.org/10.1016/j.jecp.2025.106290>
- Kube, D., Gombert, S., Suter, B., Weidlich, J., Kreijns, K., & Drachsler, H. (2024). Hacking gender in computer-supported collaborative learning: The experience of being in mixed-gender teams at a computer science hackathon. *Journal of Computer Assisted Learning*, 40(6), 2513–2527.

<https://doi.org/10.1111/jcal.12905>

Kube, D., Weidlich, J., Kreijns, K., & Drachsler, H. (2024). Addressing gender in STEM classrooms: The impact of gender bias on women scientists' experiences in higher education careers in Germany. *Education and Information Technologies*, 29(15), 20135–20162.

<https://doi.org/10.1007/s10639-024-12669-0>

Kumar, A., Gawande, A., & Raibagkar, S. (2022). Quality complacency in Indian higher education institutions between the second and third cycles of accreditation. *Quality Assurance in Education*, 30(4), 431–445. <https://doi.org/10.1108/QAE-01-2022-0019>

Lamba, N., Kishore, S., & Khokhlova, O. (2023). Examining racial and gender biases in teaching evaluations of instructors by students on an online platform in the UAE. *Frontiers in Education*, 8, Article 1237672. <https://doi.org/10.3389/feduc.2023.1237672>

Lee, H., & Chen, S. (2025). Systematic bias of machine learning regression models and correction. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 47(6), 4974–4983. <https://doi.org/10.1109/TPAMI.2025.3552368>

Lennon-Maslin, M., & Quaiser-Pohl, C. M. (2024). "It's different for girls!" The role of anxiety, physiological arousal, and subject preferences in primary school children's math and mental rotation performance. *Behavioral Sciences*, 14(9), Article 809. <https://doi.org/10.3390/bs14090809>

Lennon-Maslin, M., Quaiser-Pohl, C. M., Ruthsatz, V., & Saunders, M. (2023). Under my skin: Reducing bias in STEM through new approaches to assessment of spatial abilities considering the role of emotional regulation. *Social Sciences*, 12(6), Article 356. <https://doi.org/10.3390/socsci12060356>

Llorens, A., Tzovara, A., Bellier, L., Bhaya-Grossman, I., Bidet-Caulet, A., Chang, W. K., Cross, Z. R., Dominguez-Faus, R., Flinker, A., Fonken, Y., Gorenstein, M. A., Holdgraf, C., Hoy, C. W., Ivanova, M. V., Jimenez, R. T., Jun, S., Kam, J. W. Y., Kidd, C., Marcelle, E., ... Dronkers, N. F. (2021). Gender bias in academia: A lifetime problem that needs solutions. *Neuron*, 109(13), 2047–2074. <https://doi.org/10.1016/j.neuron.2021.06.002>

Lukitasari, M., Listiani, I., Utami, S., Irwandi, I., Sukri, A., Hasan, R., & Cortez, A. O. (2025). Development and validation of the STEM-DT instrument: A confirmatory factor analysis for assessing readiness STEM and design thinking competencies. *TEM Journal*, 14(1), 836–847. <https://doi.org/10.18421/TEM141-74>

- Maisano, D. A., Carrera, G., Mastrogiamco, L., & Franceschini, F. (2024). Remote STEM education in the post-pandemic period: Challenges from the perspective of students and faculty. *International Journal of Educational Technology in Higher Education*, 21(1), Article 35. <https://doi.org/10.1186/s41239-024-00497-8>
- Malespina, A., Seifollahi, F., & Singh, C. (2024). Bioscience students in physics courses with higher test anxiety have lower grades on high-stakes assessments and women report more test anxiety than men. *Education Sciences*, 14(10), Article 1092. <https://doi.org/10.3390/educsci14101092>
- Mansour, N., Said, Z., & Abu-Tineh, A. (2024). Factors impacting science and mathematics teachers' competencies and self-efficacy in TPACK for PBL and STEM. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(5), Article em2446. <https://doi.org/10.29333/ejmste/14467>
- McGrath, S., & Yamada, S. (2023). Skills for development and vocational education and training: Current and emergent trends. *International Journal of Educational Development*, 102, Article 102853. <https://doi.org/10.1016/j.ijedudev.2023.102853>
- Meijer, K., Baartman, L., Vermeulen, M., & de Bruijn, E. (2025). Mapping teachers' perceived importance of assessment competence: A quantitative exploration in the context of Dutch Higher Vocational Education. *Empirical Research in Vocational Education and Training*, 17(1), 1–20. <https://doi.org/10.1186/s40461-025-00185-5>
- Meoli, A., Piva, E., & Righi, H. (2024). Missing women in STEM occupations: The impact of university education on the gender gap in graduates' transition to work. *Research Policy*, 53(8), Article 105072. <https://doi.org/10.1016/j.respol.2024.105072>
- Morgan, K. (2024). Improving representation of women in the chemical engineering undergraduate curriculum. *Journal of Chemical Education*, 101(6), 2585–2590. <https://doi.org/10.1021/acs.jchemed.4c00117>
- Morselli, D. (2024). To assess or not to assess an entrepreneurship competence in vocational education and training? Results from a case study of Italy. *Education + Training*, 66(10), 29–41. <https://doi.org/10.1108/ET-06-2023-0242>
- Morsi, W. K., & Assem, H. M. (2024). Gender differences: The impact of gender grouping on Egyptian STEM undergraduates' online group work. *Mextesol Journal*, 48(4), 1–26. <https://doi.org/10.61871/mj.v48n4-8>
- Niousha, R., Saito, D., Washizaki, H., & Fukazawa, Y. (2023). Investigating the effect of binary gender

- preferences on computational thinking skills. *Education Sciences*, 13(5), Article 433. <https://doi.org/10.3390/educsci13050433>
- Owen, A. L., De Bruin, E., & Wu, S. (2025). Can you mitigate gender bias in student evaluations of teaching? Evaluating alternative methods of soliciting feedback. *Assessment & Evaluation in Higher Education*, 50(3), 442–457. <https://doi.org/10.1080/02602938.2024.2407927>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), Article 89. <https://doi.org/10.1186/s13643-021-01626-4>
- Palobo, M., Sulaiman, R., & Rahaju, E. B. (2025). Gender differences and learning styles: Impact on students geometric thinking and quadrilateral area comprehension. *Perspectives of Science and Education*, 72(6), 261–276. <https://doi.org/10.32744/pse.2024.6.17>
- Pont-Niclòs, I., Martín-Ezpeleta, A., & Echegoyen-Sanz, Y. (2024). Scientific creativity in secondary students and its relationship with STEM-related attitudes, engagement and work intentions. *Frontiers in Education*, 9, Article 1382541. <https://doi.org/10.3389/feduc.2024.1382541>
- Rausch, A., Abele, S., Deutscher, V., Greiff, S., Kis, V., Messenger, S., Shackleton, J., Tramonte, L., Ward, M., & Winther, E. (2024). Designing an international large-scale assessment of professional competencies and employability skills: Emerging avenues and challenges of OECD's PISA-VET. *Vocations and Learning*, 17(3), 393–432. <https://doi.org/10.1007/s12186-024-09347-0>
- Rozgonjuk, D., Täht, K., Soobard, R., Teppa, M., & Rannikmäe, M. (2024). The S in STEM: Gender differences in science anxiety and its relations with science test performance-related variables. *International Journal of STEM Education*, 11(1), 1–15. <https://doi.org/10.1186/s40594-024-00504-4>
- Samsul, S. A., Yahaya, N., & Abuhassna, H. (2023). Education big data and learning analytics: A bibliometric analysis. *Humanities and Social Sciences Communications*, 10(1), Article 655. <https://doi.org/10.1057/s41599-023-02176-x>
- Sandal, A. K. (2023). Vocational teachers' professional development in assessment for learning. *Journal of Vocational Education & Training*, 75(4), 654–676. <https://doi.org/10.1080/13636820.2021.1934721>
- Sarabi, Y., & Smith, M. (2023). Gender diversity and publication activity—An analysis of STEM in the

- UK. *Research Evaluation*, 32(2), 321–331. <https://doi.org/10.1093/reseval/rvad008>
- Setiyawan, A., Soeharto, S., Wijaya, T. T., Korenova, L., & Lavicza, Z. (2025). Measuring teachers' competencies for AI integration: Development and validation of the AI-TPACK in vocational education. *Computers and Education Open*, 9, Article 100319. <https://doi.org/10.1016/j.caeo.2025.100319>
- Shanks, D. R., Coles, H. A., & Yeo, N. (2024). A re-evaluation of gender bias in receptiveness to scientific evidence of gender bias. *Royal Society Open Science*, 11(9), Article 240419. <https://doi.org/10.1098/rsos.240419>
- Villarroel, V., Melipillán, R., Santana, J., & Aguirre, D. (2024). How authentic are assessments in vocational education? An analysis from Chilean teachers, students, and examinations. *Frontiers in Education*, 9, Article 1308688. <https://doi.org/10.3389/feduc.2024.1308688>
- Vlachopoulos, D., & Makri, A. (2024). A systematic literature review on authentic assessment in higher education: Best practices for the development of 21st century skills, and policy considerations. *Studies in Educational Evaluation*, 83, Article 101425. <https://doi.org/10.1016/j.stueduc.2024.101425>
- World Bank Group. (2025). *Unlocking girls' and women's economic potential with education*. World Bank Group. <https://www.worldbank.org/en/topic/girlseducation>
- Wright, N. A. (2025). Girls dominate, boys left behind: Decomposing the gender gap in education outcomes in Jamaica. *Economía*, 24(1), 1–48. <https://doi.org/10.31389/eco.462>
- Yan, C., & Liu, C. (2025). A study on stereotypes about vocational education and its groups in China. *Education + Training*, 67(5–6), 612–628. <https://doi.org/10.1108/ET-12-2024-0568>
- Yang, A. J., Ding, Y., & Liu, M. (2024). Female-led teams produce more innovative ideas yet receive less scientific impact. *Quantitative Science Studies*, 5(4), 861–881. https://doi.org/10.1162/qss_a_00335
- Yasdin, Y., Hasriani, H., & Yusuf, A. Z. (2025). Voice of socio-cultural values in the dynamics of career choices for vocational higher education students. *Higher Education, Skills and Work-Based Learning*, 15(4), 822–835. <https://doi.org/10.1108/HESWBL-05-2024-0126>
- Yim, I. H. Y., Su, J., & Wegerif, R. (2024). STEAM in practice and research in primary schools: A systematic literature review. *Research in Science & Technological Education*, 1–25. <https://doi.org/10.1080/02635143.2024.2440424>
- You, C., Awang, S. R., & Wu, Y. (2024). Bibliometric analysis of global research trends on higher Gendered Performance Inequities ... (Sahara. S et al)

Email : joves@mpv.uad.ac.id

Website : <http://journal2.uad.ac.id/index.php/joves>

- education leadership development using Scopus database from 2013–2023. *Discover Sustainability*, 5(1), Article 326. <https://doi.org/10.1007/s43621-024-00432-x>
- Zanga, G., & De Gioannis, E. (2023). Discrimination in grading: A scoping review of studies on teachers' discrimination in school. *Studies in Educational Evaluation*, 78, Article 101284. <https://doi.org/10.1016/j.stueduc.2023.101284>
- Zervas, I., & Stiakakis, E. (2024). Digital skills in vocational education and training: Investigating the impact of Erasmus, digital tools, and educational platforms. *Journal of Infrastructure, Policy and Development*, 8(8), Article 8415. <https://doi.org/10.24294/jipd.v8i8.8415>
- Zúñiga-Mejías, V., & Huincahue, J. (2024). Gender stereotypes in STEM: A systemic review of studies conducted at primary and secondary school. *Educação e Pesquisa*, 50, Article e258677. <https://doi.org/10.1590/s1678-4634202450258677>