



Evidence based approaches for enhancing vocational education worldwide

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Vocational Education and Training (VET), a key subset of formal education, bridges the gap between academic knowledge and the practical skills demanded by the job market. The PISA-VET initiative, led by the OECD, introduces a novel framework for assessing occupation-specific skills and employability competencies in five targeted vocational domains. This paper explores the potential of PISA-VET to drive meaningful reforms and foster international collaboration in vocational education.

Formal education is a key driver of economic progress, playing a crucial role in personal and societal development by providing structured learning experiences and opportunities to acquire skills. It drives societal progress by empowering individuals and equipping them with essential skills, critical thinking abilities, and specialized expertise needed for various professions. Through a standardized curriculum, formal education ensures a consistent foundation in competencies such as literacy, numeracy, and scientific understanding, fostering intellectual growth and cultural awareness. It also promotes socialization and civic responsibility, preparing individuals to contribute positively to their communities.

Vocational Education and Training (VET) is a strand of education found across the globe. VET bridges an important gap between academic knowledge and practical skills required on the job market. VET programs are designed to equip students with hands-on experience and specialized competencies directly applicable to specific industries, enhancing employability and workforce readiness. VET programs often collaborate with businesses and industries, ensuring curricula remain relevant and aligned with market needs. Being reliant on the inputs from economy and industry, VET programs differ across countries in structure and content as well as in their role in the wider educational system, reflecting sometimes striking between-country differences.

On-the backdrop of evidence-based policy making in the field of education and educational governance, international large-scale assessments, such as PISA or PIAAC, have become important contributors in shaping educational policy by providing comparative cross-national data on student performance and core workplace skills, respectively. PISA assessment focuses on 15-year-old students at the end of their mandatory schooling and evaluates key competencies, offering insights into the effectiveness of different educational systems. Policymakers use this data to identify strengths and weaknesses in the educational system to inform policies such as resource allocation, and to implement evidence-based

reforms. By highlighting best practices and successful strategies, international assessments foster global collaboration and facilitate progress in education across all the participating countries. Ultimately, these assessments are meant to drive improvements in educational quality and equity, helping to ensure all students have access to high-quality learning opportunities.

Unfortunately, international large-scale assessments were disconnected from the VET sector and typically did not include students in dedicated VET programs even though they might make up a substantial proportion of the student body. Important occupation-specific technical skills (e.g., technical problem solving such as diagnosing a mechanical failure in an engine) that are habitual targets of VET programs are not among the constructs assessed within studies such as PISA and/or PIAAC. As a result, educational systems typically do not possess extensive information about the existing levels of occupation-specific technical skills among the population of VET students, even though this is a large population (e.g., in Germany almost 50% of all students are at some point during their formal education in the VET system). This gap mandates an extension of comparative educational assessments with a new and VET-dedicated international assessment, a step that some national policy makers and researchers have long called for. Historically, efforts to validly capture the educational outcomes of VET programs have been made in various countries. For example, in Germany, the ASCOT+ initiative (2019-2022) aimed to enhance the objective measurement of apprentices' achievements and advance competence-oriented assessments. Such projects have encouraged the development of a cross-country, OECD supported initiative, the PISA-VET.

The PISA-VET initiative

The PISA-VET initiative is an OECD-led project that aims to evaluate the skills of learners nearing completion of their VET programs in five specific occupational areas: Automotive Technician, Business and Administration, Electrician Craft/Industry, Healthcare (focusing on Nursing Assistants), and Tourism and Hospitality¹. This initiative is an important step in taking VET education in the spotlight of international policy attention. The proposed framework is explicitly focused on specific occupations, unlike other large-scale assessments that focus on generic (and more rarely on specific) competencies, but usually within the general tracks of compulsory education. Within each of the five areas, the assessments focus on occupation-specific skills that are or should be the focal outcomes of VET programs. Aside from the occupation-specific skills, the assessment will capture a set of foundational, transversal competencies that were deemed as relevant across the five occupational areas —these “employability skills” (collaboration, literacy, problem solving and task performance). The components of PISA-VET were included in Fig. 1. The current paper will present potential benefits of PISA-VET and will critically examine the challenges.

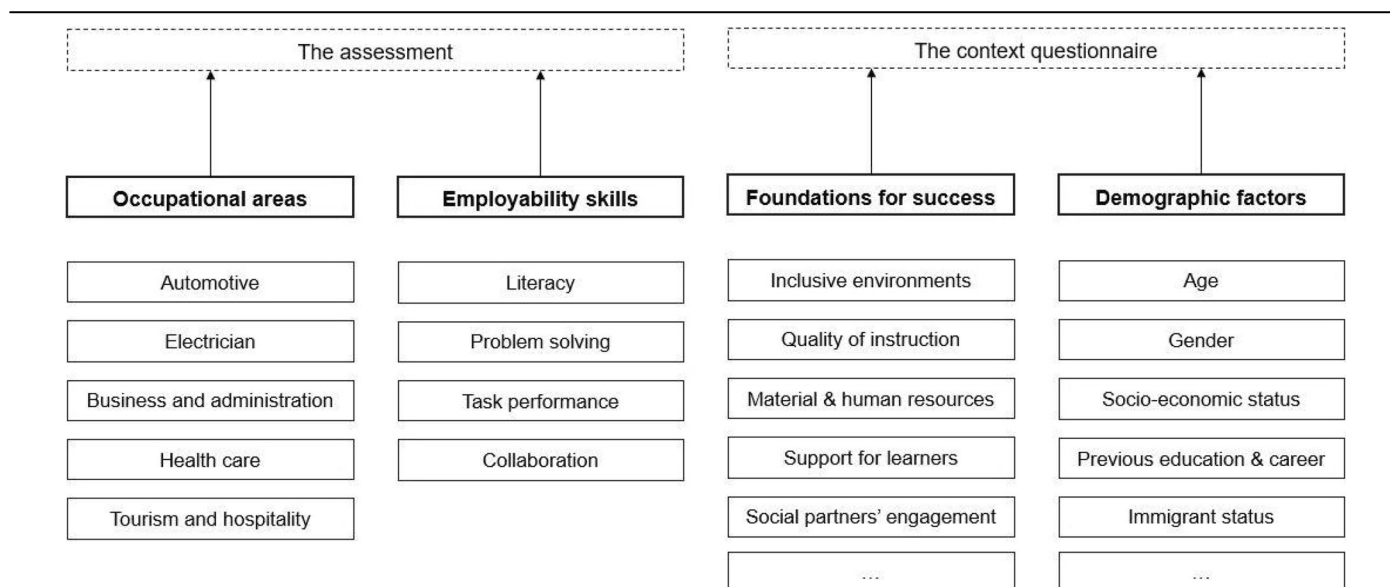


Fig. 1 | Components of the PISA-VET assessment. It presents the main elements targeted by the PISA-VET assessment.

PISA-VET introduces some fundamentally new elements that set it apart from existing large-scale assessments like PISA and PIAAC. First, PISA-VET targets a population that has been largely overlooked by previous large scale educational assessment initiatives. Although the percentage of workforce undergoing VET education varies between countries, OECD² reports that approximately one third of individuals aged between 25 and 34 have a vocational qualification as their highest education. Thus, PISA-VET represents the first standardized educational testing initiative that will provide information about this understudied segment of the future workforce while it still attends formal education. A potentially hindering factor in the generalizability of findings based on the roll-out of the PISA-VET assessment consists in the age range of the targeted population. More specifically, VET programs also include students that have ages that fall outside the targeted age-range (18–20 years).

Second, PISA-VET *shifts the assessment focus* from academic skills (mathematics, reading, science) to *vocational education and training outcomes* (such as occupation-specific skills and competencies), which have been historically underrepresented in global educational assessment initiatives. This is significant because it recognizes that learning pathways are diverse and potentially unique for different career paths. Consequently, vocational students require an evaluation that aligns with the skills they are building for becoming part of the active workforce, including employability skills, not just academic knowledge.

Third, PISA-VET introduces a *focus at the intersection of education and employment-relevant skills*. The merging of the two broad assessment domains (occupation-specific skills and employability skills) brings a new level of insight into how vocational programs can better prepare students for an evolving job market. By capturing both occupation-specific and universally required constructs (employability skills), PISA-VET provides a comprehensive assessment framework that evaluates the preparedness of VET students for the workforce, ensuring they possess not only technical expertise but also the adaptable, transferable skills necessary for success in a rapidly changing labor market.

Fourth, the PISA-VET introduces not only a simulation-oriented assessment but also includes hands-on demonstrations, enabling a more valid and realistic measurement of the key skills and competencies it focuses

on. PISA-VET includes *digitalized simulations* and *demonstrations of occupation-specific skills*. Simulations include simplified representations of occupation-specific processes that the prospective incumbents are expected to master. For example, simulations employed for automotive technicians might include items requiring the test-takers to perform various measurements using specific instruments (e.g., how to measure the voltage on a connector pin). Live or recorded demonstrations will consist of the test-taker being required to perform various tasks, such as inspecting an automobile using the manufacturers' instruction sheets. The importance of this innovation is twofold: (1) it has the potential to emulate real-world settings, potentially increasing the validity and relevance of the assessment results and (2) it has the potential to increase the participants' engagement in completing the assessment, resulting not only in more accurate estimations of the focal skills but also in increased participation and completion rates.

Benefits of PISA-VET

The PISA-VET initiative will assess practical, job-related competencies on an international scale and to provide a direct and evidence-based comparison between different VET-programs. This initiative has the potential to significantly enhance the labor-market relevance, quality, and equity of vocational education and training, by providing important information and insights into aspects where comparative data and information is scarce at best. Consequently, policymakers will be able to optimize existing VET programs by building on several types of assessment-derived information.

The benefits are geared primarily towards institutions and policy makers, who will gain information on structural differences in vocational education systems (e.g., analysis of educational paths and curricula, training conditions in schools and companies) and their impact on competencies, deeper insights into the various constructs that form vocational competencies (e.g., dimensionality; relations to employability skills, etc.), and data on the performance of vocational education systems in a long-term comparative analysis (trend-analysis; provided PISA-VET is conducted in consecutive cycles, similarly to PISA). For individuals, benefits are less tangible, as participating students will not receive individual scores; at the same time, a direct contact with such detailed and standardized assessments will give students a realistic job preview of the various occupation-specific

activities, enabling individuals to make informed decisions about their career paths, including opportunities for upskilling or reskilling or even making careers shifts.

From a learning perspective, PISA-VET can significantly contribute to enhancing formal education by aligning vocational training with real-world skills and workforce demands. Previous large scale assessment initiatives were focused on assessment domains that were not directly aligned with occupational requirements. By assessing the competencies acquired in vocational programs, PISA-VET provides valuable feedback on how effectively these programs are equipping students for the labor market. This feedback loop can inform educators about the gaps between what is taught and what is required on the job market, leading to curriculum improvements, standard setting and more targeted skill development. Moreover, PISA-VET emphasizes *applied* learning, bridging the gap between theory and practice. By incorporating work-based scenarios into the assessment, it encourages a shift in formal education towards more experiential, hands-on learning. This approach fosters critical thinking, problem-solving, and adaptability—skills that are essential in today's rapidly changing economy, especially in lieu of such phenomena as workplace complexity and automation, innovation and knowledge economy, collaborative and interdisciplinary work and complex global challenges^{3–5}. That is why through its findings, PISA-VET can guide educators and policymakers in designing more flexible, responsive educational systems that not only meet academic standards but also prepare students for successful careers.

Challenges in PISA-VET

PISA-VET touches on several contentious issues, that we have grouped below in three main categories: diversity of VET systems across different countries, equity and inclusivity in VET, and within-country differences in the students' level of digital competencies (a critical access skill for the test)

(1). Challenges may be raised around the complexity and diversity of VET systems *across different countries* and even within countries. One potential challenge is standardization — creating a single assessment that fairly evaluates vocational training programs that cater to the needs of vastly different economic, cultural, and industrial contexts is hugely challenging — it is difficult to develop a universal framework that adequately captures these differences without oversimplifying or misrepresenting certain systems that have all evolved in a specific historical and socio-cultural context. Three specific challenges have been suggested in the literature: diversity in VET structures, varied goals and outcomes in VET education, and different levels of alignment between VET systems and the labor market. Some of these components of these challenges are generic for international large-scale assessments, but some are more specific for PISA-VET.

- In terms of diversity in VET Structures, we mention the fact that VET systems differ significantly in terms of their design, ranging from purely school-based programs to dual systems (e.g., apprenticeships) that usually combine classroom education with on-the-job training⁶. For example, countries like Germany and Switzerland have strong dual apprenticeship models, while others like the U.S. and France rely more on school-based vocational education. The diversity in how VET is structured across countries will make it difficult to create a single assessment framework that will be applicable across all countries without significant adaptation and it might, in fact, be the case that the learning goals across different VET programs differ so substantially that the nationally expected outcomes will be difficult to compare.
- With regard to varied goals and outcomes, we note that VET systems have different goals across countries. Some focus primarily on preparing students for specific jobs, while others emphasize more general employability skills or further education⁷. This variation makes it

challenging to develop a uniform assessment framework that captures all dimensions of VET success.

- In terms of how strongly VET systems are aligned and integrated with the labor market, we note that in some countries, VET systems are closely aligned with industry needs, while in others, the connection between education and the labor market is weaker. Strong links to employers in countries like Germany and Austria ensure that VET students gain practical, work-relevant skills and many of them are later on employed in the company that originally trained them. In contrast, countries with less labor market alignment might not provide the same level of direct job preparation⁸.

(2). Another point of contention is *equity and inclusivity*. Since vocational education often includes students from lower socioeconomic backgrounds^{9,10}, there is a risk that PISA-VET could unintentionally perpetuate inequalities by highlighting underperformance without addressing the root causes, such as funding disparities, access to quality training, or tailored support earlier during formal education (i.e., pre-school, primary education, or early secondary education).

- In terms of socioeconomic segregation in VET, we note that VET systems in many countries disproportionately serve students from lower socioeconomic backgrounds, who may lack access to high-quality education and training resources. These students might already be at a disadvantage due to a lack of social capital, lower academic achievement in earlier years, or fewer post-secondary opportunities¹¹. Without accounting for these underlying inequities, assessments like PISA-VET could reinforce negative perceptions of VET systems that serve disadvantaged populations, rather than highlighting the need for structural reforms and for ways of making VET, as an integral part of formal education, more equitable and inclusive.
- Deriving from and being connected with socioeconomic segregation, vocational education is also marked by social stratification: in some countries, VET is seen as a less prestigious alternative to academic education, often leading to a perception of it as a “second choice” for students from disadvantaged backgrounds. This social stratification can further entrench inequalities, as VET students may face limited opportunities for upward mobility¹². Supplementary, gender and socioeconomic status often intersect in VET—in addition to socioeconomic inequalities, there are often gender disparities in VET enrollment and outcomes. Girls and women are sometimes under-represented in certain technical and vocational fields (e.g., STEM-related VET programs) and face additional barriers to accessing high-quality training¹³. Standardized assessments that don't address the root causes of stratification, such as societal attitudes towards vocational education, could perpetuate these divisions by labeling VET programs as underperforming without examining the broader social context.
- The lower resources allocated to VET programs often extends to the quality of teaching staff. Many VET teachers come from non-educational backgrounds, having initially trained for specific industries rather than teaching, which can result in gaps in pedagogical skills and up-to-date technical knowledge¹⁴. This mismatch makes it challenging to deliver high-quality, relevant training to students. Strengthening vocational teacher education is crucial, including providing specialized training, continuous professional development, and industry partnerships to ensure that teachers can effectively bridge the gap between academic and practical learning, thereby enhancing the overall effectiveness of VET programs.
- Regarding funding disparities and resource inequity, contemporary research shows that many VET programs face funding disparities

compared to general education pathways, which limits their ability to provide high-quality training, up-to-date technology, and well-prepared instructors. Inadequate resources can lead to poorer student outcomes, which might be misinterpreted as underperformance in assessments like PISA-VET¹⁵. If PISA-VET results are used to compare the effectiveness of different VET systems without accounting for disparities in resources, the assessment could unintentionally stigmatize schools and programs serving low-income students.

(3). There might be important between-country and within-country differences in the students' *level of digital competencies*. Employing computerized digital simulations and live demonstrations as part of the assessment process might not adequately reflect the actual occupational skills of students enrolled in various VET programs.

- There are significant disparities in digital competencies between countries, particularly between high-income nations with advanced digital infrastructures and lower-income countries where access to digital tools is limited. In lower-income countries, students may have limited experience with digital devices, software, or simulations, and their performance in computer-based assessments may not accurately reflect their vocational competencies¹⁶. Computerized assessments in countries with lower digital competences levels could lead to underperformance not because students lack occupational skills, but because they are unfamiliar with the digital platforms used in the assessments. Granted, this is a potential problem in all digital assessments, but it is likely higher in the type of assessment that was envisioned for PISA-VET, because the level of digital competencies required for working on highly realistic (and complex) simulations is larger than typically, for example, in PISA.
- Even within a single country, access to digital technology can vary dramatically depending on factors such as geographic location (urban vs. rural), socioeconomic status, and school funding levels. VET students from disadvantaged backgrounds might not have regular access to computers or the internet, which could affect their ability to navigate digital assessments¹⁷. This variation means that computerized simulations may test digital navigation skills rather than vocational competence, unfairly disadvantaging students with lower levels of digital competencies—and the volume of students with extremely low digital competencies is alarming, as shown by the recently published International Computer and Information Literacy Study¹⁸.

Limitations

In its current form, the PISA-VET has a number of potential limitations. First, the PISA-VET has a limited occupation coverage, focusing only on five occupational areas (Automotive Technicians, Electricians, Business & Administration, Healthcare Assistants, and Hotel Receptionists). Some high demand domains, such as construction, design and media, IT, transportation or renewable energy are not part of the main focus of PISA-VET, albeit their relevance and popularity might increase by 2030. Second, PISA-VET does not propose a method for tackling the inevitable influence of country-specific contexts on the design of VET-programs and on their educational outcomes: in many countries VET programs are context dependent, operating under the country-specific influence of economic, legal or cultural factors and any cross-country comparisons should propose ways to address and/or measure the influences of these factors. A third potential limitation has to do with the degree to which various activities (practical skills) can be simulated in a digitalized environment. Despite the considerable progress made in digital assessments, identifying in a digital environment that an engine does not start because of battery-failure and knowing the steps

necessary for addressing this issue, does not ensure that a technician has the necessary motor skills to actually implement the actions needed to solve this scenario. Finally, PISA-VET draws from the Competency-Based Education and Training (CBET) approach. This approach has been criticized for emphasizing practical skills which have relatively limited generalizability over theoretical knowledge¹⁹.

The road ahead

Shaping the first round of PISA-VET, currently scheduled for 2030, presents several challenges. Some of these are “the usual suspects” in such large-scale comparative assessments, such as challenges related to resource allocation, or data collection and analysis. Others are typical for new assessments, and for the VET assessment especially, and they lie in such areas as stakeholder buy-in, relevance and coverage, and standardization across countries. Achieving consensus and support from national governments, educational institutions, industry partners, and other stakeholders is essential for the successful implementation of PISA-VET - and differing priorities and interests can complicate this process. Countries have explicit (and sometimes implicit) interests in some industries rather than others and selecting the occupational areas and employability skills to be assessed while ensuring they are representative of the broader VET landscape is challenging. Balancing the inclusion of universally relevant skills with specific industry requirements is also crucial. Finally, developing a consensus-based agreed-upon assessment framework that accurately reflects the diverse VET systems and curricula of participating countries is complicated on both a scientific and psychometric, and a political level.

Addressing these challenges is critical to the successful launch and impact of the first round of PISA-VET. While maybe not that relevant for the first round, but critical for the continuation of the study, we also mention that the VET landscape is continually evolving due to technological advancements and changing labor-market needs, in a world where jobs evolve rapidly and tasks become outdated quickly. Ensuring that future cycles are (technically) connected to previous cycles and, at the same time, remain up-to-date with changes on the labor market is an ongoing challenge and should also drive the development of the first round.

A particular challenge that is commonly associated with international large-scale assessments is the (mis)use of league tables as a primary focus for media attention, public discussion, and policy-making; PISA and other similar programs show how much of an issue this can be. To make the most of PISA-VET beyond simple league tables and beyond just a benchmarking exercise, stakeholders must focus on interpreting the data in a way that *drives meaningful change* in vocational education. First, a deep analysis of the results can highlight strengths and weaknesses in specific competencies, enabling targeted reforms in curricula and teaching methods. PISA-VET will provide an excellent alignment opportunity for educators, policy-makers, and business representatives or commerce associations. The insights derived from the PISA-VET will enable the relevant parties to tailor programs that better match industry demands and improve student outcomes if used correctly. Second, PISA-VET can foster international collaboration by facilitating the sharing of best practices across countries, helping to elevate VET systems globally. Third, the PISA-VET result will provide an opportunity to standardize and/or align the curricula of various VET programs. Fourth and finally, engaging with industry partners to interpret the findings can ensure that the data translates into actionable insights, improving the alignment between education and the labor-market.

PISA-VET—an interdisciplinary journey

Different domains can contribute to the success of PISA-VET by leveraging their unique expertise and resources: interdisciplinary collaboration will be

vital for the successful implementation of PISA-VET because vocational education intersects multiple domains, including education, labor-market needs, and technological advancements—not even mentioning the profound difference between the various industrial domains that come under the umbrella-term VET. Interdisciplinary collaboration will be vital for the successful implementation of PISA-VET, given the multifaceted nature of vocational education, which spans domains such as education, labor-market dynamics, technological advancements, and diverse industrial sectors. *Experts in education* provide insights into curriculum design and the learning frameworks necessary for effective skill development in VET contexts. *Economists and labor-market experts* contribute by sharing inputs regarding the current and future workforce demands, ensuring alignment to the current and prospective market needs. *Engineers and technologists* help integrate emerging technologies into the assessment framework, reflecting the digital transformation of industries. *Industrial, technical and job-experts* from the targeted work sectors offer detailed knowledge of occupation-specific skills and real-world tasks critical for workforce readiness. *Psychologists and psychometricians* bring expertise in designing reliable and valid assessment tools tailored to the unique challenges of vocational training. Finally, *sociologists* provide a broader perspective on how societal factors, such as equity and access, intersect with vocational education and training.

Conclusions

The PISA-VET study is groundbreaking because it fills a critical gap in global education assessments by focusing on an area often overshadowed by studies that focus on general formal education. Traditional assessments like PISA primarily evaluate academic proficiency and applied skills, but they miss a significant portion of the student population engaged in vocational pathways. PISA-VET is set to address this by assessing the skills, competencies, and readiness of vocational students, offering unprecedented insights into how well VET systems are preparing students for the labor market.

In an era where the demand for technical skills is surging, understanding the effectiveness of VET is essential. PISA-VET provides data that can reshape how countries view and invest in vocational education, making it a key tool for both education and workforce development. Researchers, especially, should pay close attention to this study. It opens new avenues for exploring the relationship between education and employability, providing rich data that can inform policy, improve pedagogy, and ultimately help close skills gaps.

Data availability

No datasets were generated or analysed during the current study.

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Author Contributions

D.I.: Conceptualization, Writing - Original Draft, Writing - Review & Editing. S.G.: Conceptualization, Writing - Original Draft, Writing - Review & Editing. A.I.: Corresponding author, Writing - Review & Editing.

Competing interests

There is a conflict of interest. Some of the authors will continue to be actively involved in the design of PISA-VET. They might receive financial compensation from OECD for these efforts.

Additional information

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