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Maths in vocational schools: perspectives, challenges, opportunities

Dear Reader! Imagine you're 17 years old and living in the countryside in Poland. You attend a vocational school, training to become a carpenter. The school is in a town a few kilometers away, so you have to wake up very early in the morning to catch a bus that will get you there on time. Although you'll have to wait another hour for classes to start, it's the only way to avoid being late. Your goal at this stage of your education is pragmatic and very clear: you want to learn a specific trade, become independent as soon as possible, start working and begin earning money. You also have a part-time job after classes, which, combined with the lengthy commute and the hours spent at school, leaves you feeling tired.

At school, you divide your time between practical training, vocational subjects, and general education subjects. In practical classes, you see the tangible results of your work. Your practical training supervisors appreciate what you can do, and you're praised by your teachers. Even if you have gaps in your understanding of the theoretical foundations of the profession and don't understand everything right away, your manual skills, experience and intuition can help you build a sense of self-worth and competence. Gaps in knowledge won't result in an immediate feeling of being lost; they can usually be made up for. Vocational training is definitely your priority and you really care about it; you don't come to school for knowledge in general subjects. At the same time, attending classes is necessary to learn the trade[1] . You try to take from them what might be useful to you. In English class, you learn basic phrases; they might come in handy if you ever decide to work abroad. In biology, the teacher talks about organ systems or diseases; you find this interesting because you can easily relate it to your own life – after all, you've been curious about nature since elementary school. You're not interested in the humanities, but if you have to get a grade, you sit down and memorize the dates and locations of battles. Fortunately, a good memory is enough here, and not knowing much about antiquity doesn't prevent you from doing well on a test about the Middle Ages.

Then there are math classes. Here, you often hit a wall. Rows of numbers, algebra, fractions and abstract geometric figures appear on the board. On top of that, you see them exclusively on a flat, interactive board, because the school doesn't have enough math labs (and

[1] Unlocking Potential. Key barriers and opportunities in teaching math in technical and vocational schools. Research Report, 2026, https://think.org.pl/wp-content/uploads/2026/02/Report_UnlockingPotential_180226_Final.pdf/, accessed March 26, 2026

anyway, 3D models are only found in a few of them)[2] and you like to learn by experiencing, touching and handling things. What you encounter every day in the woodshop – working with solid, three dimensional objects – becomes yet another abstraction in the classroom. You feel lost and often ask yourself, “What’s the point of this?” Math is often taught in a rote manner, by solving one equation after another from a textbook, which means it has no connection to your life. This is confirmed by research: as many as 43% of first-year high school students surveyed in Poland stated that during their first months of learning math, they never (or almost never) heard how mathematical tools and concepts would be useful to them in everyday life[3] . This creates deep frustration.
You’re constantly on edge; you can’t let your guard down even for a moment, because if you don’t understand the current topic, you won’t be able to comprehend the next one. Everything stems from this. You feel helpless and increasingly tense. When you think back to your elementary school days, you remember that math lessons always seemed difficult to you, which is why you have a significant gap in your knowledge from that time. Unfortunately, at your new school, there’s no chance to start with a “clean slate”; it quickly becomes clear that the knowledge from your previous level of education is needed right away. In your head, you hear the voice of your elementary school teacher commenting on your shortcomings in front of the whole class[4] .

To better understand the reasons behind your fear and aversion to this subject, let’s step out of school for a moment and head to your family home. The report *Unlocking Potential. Key barriers and opportunities in teaching math in technical and vocational schools* strongly emphasizes biographical barriers and family context in the teaching and learning of mathematics[5] . For many teenagers in vocational schools, math education is not treated as a priority in the family environment: “Mom said she doesn’t know math, so I don’t have to either”[6] .

You may also “inherit” a fear of math. Teachers point to a lack of confidence in one’s abilities that *is passed down* from generation to generation: *Fear of math is passed down in families. Some parents come to me and say that, just like their child, they weren’t good at math. (...)*[7]

It may also be the case that you’re a good student, you came to vocational school already with some knowledge, you’d like to learn more, but you feel pressure from your peers. Your classmates aren’t happy when you volunteer to answer[8]; they treat class as a time for chatting and eating. So you sit at your desk, not taking the initiative, because you worry about what others might think about you. Perhaps you’d like to attend extra classes, but they’re during the last period, so issues with commuting and lack of time prevent you from

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[2] Supreme Audit Office, Vocational Education. Audit Results (2024), https://www.nik.gov.pl/plik/id,29659,vp,32517.pdf. Accessed: March 25, 2026

[3] Polish 15-Year-Olds in an International Perspective. Results of the PISA 2022 Study. Collective work edited by Joanna Kaźmierczak and Krzysztof Bulkowski, IBE, 2024. p. 86. Accessed: March 25, 2026.

[4] Unlocking Potential. Key barriers and opportunities in teaching math in technical and vocational schools. Research Report, 2026, https://think.org.pl/wp-content/uploads/2026/02/Report_UnlockingPotential_180226_Final.pdf, acessed March 26, 2026

[5] ibid

[6] ibid

[7] ibid

[8] ibid

doing so. In fact, such classes might not even exist if there's no available classroom or the school is short-staffed.

This picture of mathematics as a school subject emerges from the report *Unlocking Potential.* Particularly in vocational schools, students' attitudes reveal a clear division between subjects they consider more important (vocational subjects, internships) and those they treat casually. Influenced, among other things, by the attitudes of parents and teachers from earlier stages of education, young people come to school with a strong conviction that *math isn't for me*[9] . This, in turn, causes psychological turmoil – students stop believing in themselves, are convinced of inevitable failure and give up when difficulties arise. Low self-esteem and fear of ridicule paralyze them to such an extent that even when they solve a problem correctly, they often find it hard to believe that their solution is correct[10] .

Problems in learning and teaching mathematics are exacerbated by outdated and inadequate systemic solutions. In Poland, the structure of vocational school education means that teachers follow the same core curriculum for students in different trades, and it is designed as if the goal were to prepare students for the high school final exam. This inflexible and misguided approach results in the curriculum imposing an overly fast pace and excessive amount of material. Given that the vast majority of vocational school students do not plan to continue their education after high school[11] , this approach seems ill-suited to their actual needs. The situation is further exacerbated by a lack of engaging educational materials related to everyday life and issues relevant to teenagers and young adults.

Research conducted as part of the project "Math Is Everywhere. Added Value – A Step Up!" show that teachers in other European countries also face many similar challenges. Spanish teachers emphasize that students often face major issues, e.g., in the area of mental health, but due to limited support in the community, these are not always recognized and acted upon quickly and appropriately. Educators from Formación Profesional Básica (FPB), where teenagers who have not completed compulsory lower secondary education end up, often having a history of educational setbacks, say that they frequently play a role similar to that of social workers. They have to interrupt lessons to resolve classroom conflicts or provide emotional support to students. Spanish FPB teachers emphasize that they constantly go back to the basics, break down problems into small steps, and ensure that the topic has actually been understood. A systemic approach helps with this – within FPB, mathematics is part of a broader applied sciences module, which aims to facilitate the recognition of interdisciplinary connections.

According to the report, during math lessons, some Dutch students exhibit signs that may indicate anxiety -- avoiding contact with the teacher or, conversely, constantly seeking their attention. They may ask to go to the restroom several times during a single lesson, constantly seek confirmation from the teacher that they are doing well, or demand extra attention. There are also students who would like to "disappear" during class and try not to

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[9] ibid

[10] ibid

[11] Supreme Audit Office, Vocational Education. Audit Results (2024), https://www.nik.gov.pl/plik/id,29659,vp,32517.pdf . Accessed: March 25, 2026

stand out. Any interaction that does not involve math may be seen as a safer option, even if it attracts negative attention.

In each of the countries included in the study, measures are being taken to support students in their mathematics education. To reach a student like the one described in the introduction – tired of balancing school and work, convinced of a lack of aptitude for math and afraid of failure – we must develop an approach based on trust and a lack of fear of making mistakes. As one Polish teacher explains: "Mistakes are meant to teach us, not discourage us. We make mistakes so that we remember not to do things that way, and sometimes we have to make the same mistake more than once"[12] .

In the Netherlands, within the system of vocational secondary schools (MBO) and preparatory vocational schools (VMBO), teachers strive to "familiarize" students with mathematics, using methods such as *Building Thinking Classrooms* to encourage students to work in teams around whiteboards and formulate their own research questions, ideally based on a mathematical problem sourced directly from their daily lives. The idea is to reduce the pressure to get a passing grade and to replace traditional lectures with discussion.

Spanish teachers often work with the student's mindset: *The biggest challenge is to help students overcome their own low expectations, as they have a mindset of "I don't know, I've never been able to, and I never will be able to"*[13] .

A Polish teacher emphasizes the importance of using simple, student-friendly language as one way to help students become familiar with mathematical concepts: *I often explain this math using plain, everyday language so they know [what I'm talking about]. Because when I told them we had to multiply by the denominator, add the numerator, and so on, some of them just looked at me… (...) But when you say it's "bottom times top," they say, "Okay, now I get it"*[14] .

In the report *Unlocking Potential* based on the research conducted, the authors also suggest other principles that can be relied upon in teaching mathematics:

- The teacher fosters a sense of security and a learning environment where making mistakes is a natural and constant part of the learning process.
- Grounding math in real life – practical examples related to finance, technology, or specific professions.
- Using gamification methods – games, quizzes, simulations and small-group work with elements of competition.
- Using a simple, organized and predictable lesson structure.
- Extensive non-grading feedback, highlighting even small successes and constructively pointing out areas for improvement.

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[12] Unlocking Potential. Key barriers and opportunities in teaching math in technical and vocational schools. Research Report, 2026, https://think.org.pl/wp-content/uploads/2026/02/Report_UnlockingPotential_180226_Final.pdf/, accessed March 26, 2026

[13] Unlocking Potential. Key barriers and opportunities in teaching math in technical and vocational schools. Research Report, 2026, https://think.org.pl/wp-content/uploads/2026/02/Report_UnlockingPotential_180226_Final.pdf/, accessed March 26, 2026.

[14] ibid

Mathematics is a tool for critical thinking that facilitates the navigation of a complex world - essential for young people entering adult life. A shift in approach to this subject must begin by grounding it in a real-world context, understanding the sources of students' difficulties, and respecting their life priorities.

If you want to more effectively support students in vocational and technical schools, gain a deeper understanding of the barriers and opportunities for making a positive impact in mathematics instruction and if you are looking for proven recommendations for creating engaging educational materials, read the full text of the report *Unlocking Potential. Key barriers and opportunities in teaching math in technical and vocational schools*.

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