Austria

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Introduction

Austria is a federal parliamentary republic consisting of nine provinces (*Bundesländer*), each with its own provincial government. Responsibility for legislation and its implementation is divided between the federation (*Bund*) and the provinces. Austria's official language is German, with Slovenian, Croatian, and Hungarian as official languages in some districts in Carinthia and Burgenland.[b] German is also the language of instruction except in districts with multiple languages. Primary school lessons in these districts are bilingual; German and either Slovenian, Croatian, or Hungarian must be used equally in instruction. Some compulsory secondary schools have a minority language as a required subject at the lower secondary level, and there is one Slovene secondary academic school in the country. Since the 2003–2004 academic year, Austria has introduced a modern foreign language course in all primary schools beginning in Grade 1.

Overview of Education System

The Austrian education system is hierarchically organized, centralized, and selective at an early stage. The Federal Ministry of Education, Science and Research is responsible for primary, secondary, and tertiary education, as well as for the university colleges of teacher education (*Pädagogische Hochschulen*). Its supervisory responsibilities include all areas of school management, the organization of school instruction in public and private schools, and the service code of teachers employed by the Federal Ministry.

Austria's nine provinces have legislative responsibility for providing kindergarten and public sector compulsory education. They support local communities in establishing and maintaining these schools via the school construction funds they administer. Each province has a board of education (*Bildungsdirektion*) headed by a director of education. The board consists of an administrative department (*Präsidialbereich*), which is responsible in particular for personnel administration and accounting, and also a pedagogical department (*Pädagogischer Dienst*),

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b Apart from Slovenians, Croatians, and Hungarians, minorities include Czechs, Slovaks, and Roma people.

which is responsible for school supervision and quality management for different educational regions as well as for different content areas—for example, school quality, inclusion, and diversity.

Preprimary education is available for children up to age 6 via crèches, kindergartens, and private childcare providers. Since 2010, 1 year of kindergarten has been compulsory for all children age 5 before they start attending primary school (*Volksschule*) at age 6. Education is compulsory for 9 years (Grades 1 to 9). *Volksschule* encompasses Grades 1 to 4 for students ages 6 to 10.[c] Parents of children whose 6th birthday falls before March 1 in the following calendar year may request earlier school admission provided that the child is mature enough and has the required social competency to attend school. Six-year-old children considered insufficiently mature to attend school must attend preschool (*Vorschule*). *Volksschule* comprises Primary Level I (preschool stage where required and Grades 1 and 2) and Primary Level II (Grades 3 and 4). At the lower secondary level (Grades 5 to 8), students ages 10 to 14 can apply for entry to a lower-level academic secondary school (*Allgemeinbildende höhere Schule—Unterstufe*) or a compulsory secondary school (*Mittelschule*).

Austria has reformed lower secondary education (United Nations Educational, Scientific and Cultural Organization [UNESCO]'s International Standard Classification of Education [ISCED] 2) to reduce the effects of streaming students into different educational tracks too early.[1] The Austrian government introduced the compulsory secondary school scheme as a pilot project in academic year 2008–2009; parliament passed the legislation in 2012. By academic year 2018–2019, all general secondary schools (*Hauptschulen*) were transformed into compulsory secondary schools.[2] A central feature of the compulsory secondary school curriculum is the broad implementation of a new learning culture based on individualization and inner differentiation.

The upper secondary level (Grades 9 to 13) comprises a general education branch and a vocational branch. General upper secondary education includes

- prevocational school (Grade 9),
- the upper level of academic secondary school (*AHS-Oberstufe*) (Grades 9 to 12), and
- the matriculation examination. Passing the examination allows students to study at universities or other higher education institutions.

Vocational upper secondary education includes

- part-time vocational school, which is taken in tandem with company-based vocational training (Grades 10 to 13, but usually Grades 10 to 12),
- secondary technical and vocational school (Grades 9 to maximum 12), and
- colleges for higher vocational education (Grades 9 to 13, ISCED 3 to 5).

c Normally, children attend *Volksschule* from Grades 1 to 4. However, there are a few school locations where *Volksschule* also includes upper primary Grades 5 to 8.

Colleges for higher vocational education, early childhood education and care (ECEC), teacher training colleges, and training colleges for social pedagogues lead to the matriculation and diploma examination, which enables students to study at universities or other higher education institutions. Higher education institutions include

- public universities,
- universities of applied sciences (*Fachhochschulen*),
- private universities, and
- university colleges of teacher education.

Use and Impact of TIMSS

Austria's first participation in TIMSS goes back to the first TIMSS study in 1995. While primary school students showed high achievement levels in both mathematics and science, students in lower secondary and specifically in upper secondary schools achieved below expectations. As a result, education initiatives were started to (a) analyze the results and (b) suggest improvements.[3] Since then, Austria has participated three more times in TIMSS in Grade 4 (2007, 2011, 2019) and one more time in Grade 8 (2023). So far, the main use of TIMSS data has focused on two topics: firstly, the international comparison and specifically the comparison with neighboring countries and members of the European Union; and secondly, the review of trends over time. The results of TIMSS 1995 also triggered debates about the quality of the Austrian education system and were used as evidence for the need for reforms. Before 2012, there was no national assessment of achievement in Austria; therefore, international study data as from TIMSS were also used for system monitoring. Starting in 2012, the assessment of national education standards (*Bildungsstandards*) has been implemented in Grades 4 and 8. Since 2019, additional national assessments in Grades 3 and 7 have been decreed and were implemented in 2022 (iKM^{PLUS}).[d] However, the national assessments focus on mathematics and German as well as English reading/receptive skills. While science is not part of the compulsory annual assessments, supplementary assessment modules are offered for voluntary usage in the field of natural science. TIMSS data are therefore still the only source of information regarding science achievement at the end of primary and/or secondary education in Austria.

The Mathematics Curriculum in Primary and Lower Secondary Grades

In 2019, the mathematics curricula underwent revisions that took several years to complete. The new curricula began to be implemented in stages starting in academic year 2023–2024 in Grades 1 and 5 and will be fully implemented by academic year 2026–2027.[4] This section focuses on the curricula in place at the time of the TIMSS 2023 main study.

d See the Monitoring Student Progress in Mathematics and Science on page 10 section for more information about iKM^{PLUS}.

Fourth-Grade Mathematics Curriculum

The curriculum for primary education (Grades 1 to 4)[5] at the time of TIMSS 2023 has been in place since 2003 and consists of the following: general education targets, general rules that include instruction and education principles, general didactic principles, subject tables and suggested weekly hours per subject,[e] educational and instructional tasks, teaching content, and didactic principles for the different subjects. In terms of teaching content, the curriculum provides a framework laying out the general overarching aims and indicates subjects with content areas, which are subservient to the general aims. Thus, the curriculum is the basis for teachers to plan and implement lessons autonomously.

The mathematics curriculum is divided into the following topics: (1) structure of whole numbers, (2) arithmetic operations, (3) magnitude/sizes, and (4) geometry. For Grade 4, the curriculum also includes fractions. More detail for each topic follows:

- structure of whole numbers: For this topic, students should develop basic abilities in mathematics and be able to establish a concept of whole numbers. In Grades 1 and 2, students use numbers up to 100. In Grades 3 and 4, students' understanding of numbers should be expanded and deepened, and the number spectrum should reach up to 1,000 in Grade 3 and up to 1,000,000 in Grade 4. Students in Grade 4 should also be able to read and interpret graphical representations (e.g., tables, graphs, charts).
- arithmetic operations: In Grades 1 and 2, topics range from learning the concepts underlying the operations to carrying out all four arithmetic operations (addition, subtraction, division, and multiplication). Students should be able to use operations to solve real-life problems and to match mathematical operations to everyday situations, as well as find everyday situations to demonstrate mathematical operations. In Grades 3 and 4, the use of arithmetic operations intensifies, and the number spectrum enlarges progressively. Students should understand the role of 0 in operations and in solving simple equations featuring placeholders. Students should be able to use mathematical representations to demonstrate and solve problems, and create number games, mathematical puzzles, or strategy games.
- fractions: In Grade 4, fractions are introduced with 2, 4, or 8 as the denominator.
- magnitude/sizes: This topic includes understanding of comparisons and formulations of relationships; introduction of different units of measurement (arbitrary units and normalized units such as length, weight, time, money, and basics of volume); and applying units in different situations. In Grades 1 and 2, students develop a concept of magnitude/sizes and learn to apply different units of measurement. The focus in Grades 3 and 4 is on estimation, as well as on measuring, comparing, and

e Schools may increase or decrease the suggested number of hours per week by a maximum of 2 hours per week, but they must not cancel a mandatory subject.

transforming units of measurement. Operations with money introduce the concept of decimals and include adding and subtracting.

- geometry: The main targets for Grades 1 and 2 are observing, ordering, and structuring of spatial relationships and shapes; enhancing the ability to orientate; establishing the use of technical aids for drawing; and solving real-life problems using geometry. Students should be able to investigate and describe simple geometric figures and solve problems featuring spatial aspects or geometric figures. In Grades 3 and 4, the focus is on identifying and classifying geometric figures, measuring objects, and using drawing instruments or equipment. Students also learn how to calculate perimeter and area of rectangles and squares.

Complementing the curriculum, the national education standards for mathematics describe desired learning outcomes in Grade 4. A competence model, featuring four content dimensions and four general mathematical competency dimensions, has been established to facilitate the teaching process as well as the assessment and evaluation of learning progress.

Eighth-Grade Mathematics Curriculum

The curriculum for lower secondary schools (Grades 5 to 8) at the time of the TIMSS 2023 main study has been in place since 2000. In Grades 5 to 8 (lower secondary school, ISCED 2), two versions of the mathematics curriculum exist, one version for compulsory secondary school (*Mittelschule*)[6] and one for lower-level academic secondary school (*Allgemeinbildende höhere Schule–Unterstufe*).[7] In both school types, a minimum of two thirds of the instruction time per subject has to be devoted to "core" topics; up to one third may be chosen from "extended" topics. The topics are the same for compulsory and academic secondary school. The curriculum for compulsory secondary school lists a distinction in mathematics in Grades 7 and 8 between "basic" and "extended" educational content, where extended content is meant to foster more complex argumentation; the topics are the same for both the basic and the extended versions. In order to support students in compulsory secondary school in mastering extended content, the Federal Ministry provides additional teacher resources of up to 6 hours per week for mathematics, German, and the first foreign language.

Contents of the mathematics curriculum in Grades 5 to 8 are grouped by content and grade as follows:

- numbers and units: Students should extend their ability to use whole numbers and gain deeper familiarity with decimals, fractions, and the rules for the order of arithmetic operations. Students should be fluent in doing mental arithmetic and be enabled to use electronic devices for mathematical operations. Percentages and their use are introduced, followed by rational numbers, their representation, and coordinate systems. Students should be able to understand and reason why arithmetical situations cannot always be solved with rational numbers.
- variable, functional dependency: Students should be able to describe generic situations with variables and formulate and solve equations. From Grade 6 on,

students should be able to solve linear equations with one unknown term, transform formulas, and use formulas and equations for real-life problems. At the end of Grade 8, students should be able to solve linear equations with two variables and understand and prove functional dependencies.

- geometric figures and shapes: Students should be able to recognize and describe geometric figures and shapes and their properties, starting with calculations of perimeters and areas of rectangles, as well as volume and surface area of cubes and rectangular shapes, and work with angles and symmetric figures. In Grade 6, working with geometric figures extends to include triangles, quadrilaterals, and regular polygons and the volume of prisms. In Grade 7, new content comprises formulas to calculate the area of triangles and quadrilaterals, the Pythagorean theorem, and the increasing and scaling down of figures. In Grade 8, reasoning of the Pythagorean theorem follows, along with calculations and use of circumference and area of circles; surface areas; and volumes of pyramids, cylinders, cones, and spheres.
- models and statistics: Students should be able to use tables and graphical displays to record data, compare models with real-life situations, and understand the purpose of models. In Grade 6, characteristics of direct and indirect proportions are introduced, as well as relative frequencies and their graphical representations. Students should be able to spot manipulations. In Grade 7, focus lays on increasing and decreasing processes, such as interest loans and investigating and displaying functional dependencies. In Grade 8, students should be able to analyze data and present results of statistics such as mean, median, quartiles, relative frequencies in adequate graphs, and scatter plots.

The Science Curriculum in Primary and Lower Secondary Grades

As in mathematics, the curricula for science were undergoing revisions and the new curriculum was implemented (starting in Grades 1 and 5) in academic year 2023–2024. This section focuses on the curricula in place at the time of the TIMSS 2023 main study.

Fourth-Grade Science Curriculum

The curriculum for primary schools (Grades 1 to 4) at the time of the TIMSS 2023 main study has been in place since 2011. Science instruction in primary school is included in the integrative general science subject *Sachunterricht*, which is divided into the following learning areas: community, nature, space, time, economics, and technology. The curriculum in the primary grades includes all of these learning areas, describing the subject matter combined for Level 1 (*Grundstufe I*, Grades 1 and 2) and for Level 2 (*Grundstufe II*, Grades 3 and 4). The main difference from the TIMSS framework in the Austrian primary school curriculum is the absence of the topic Earth in the solar system, which is anchored in the content domain Earth Science in TIMSS.

In Austria, the most prevalent learning areas are nature and technology. The nature learning area focuses on understanding the environment, as well as knowledge of the human body. In Grades 1 and 2, themes are introduced with simple examples. There is also an emphasis on nature in close vicinity to the students. Grades 3 and 4 then focus on emphasizing further understanding and application.

The main topics in the nature learning area are

- life processes and biological systems, which focus on introducing scientific working methods and knowledge about life cycles and ecosystems;
- diversity in nature, such as characteristics, morphology, and habitats of certain plants and animals;
- responsible behavior toward nature, e.g., the human relationship toward nature, as well as topics of responsible behavior to protect the environment; and
- the human body and health, including learning about senses, organs, a healthy lifestyle, and hygiene and sexuality.

Technology, in conjunction with the school subject handicrafts, focuses on technical realities in the students' environment, natural forces and their effects, and materials and their transformation. In each of the corresponding topics in the technology learning area, students are introduced to specific scientific working methods. In Grades 1 and 2, the subtopic technical facts in the students' environment also relates to mechanical objects such as tools, wheels, handles, and switches. Grades 3 and 4 extend this knowledge to the indirect environment. Students also learn about handling objects and specific operational methods through examining, measuring, and experimenting with objects. Specifically, students explore objects by viewing and measuring, and conduct their first experiments. Water is an omnipresent significant theme throughout primary education, as are responsible use of technical equipment and precautionary measures to avoid accidents.

The main topics in the technology learning area are

- learning about technical conditions in the students' environment and learning about equipment and acting responsibly with it;
- forces of nature and their effects, such as natural effects like magnetic force, thermodynamic effects, weather phenomenon, and gravity; and
- materials and changes in materials, and basic and scientific working methods.

Eighth-Grade Science Curriculum

The curriculum for lower secondary schools (Grades 5 to 8) at the time of the TIMSS 2023 main study has been in place since 2000. Regarding lower secondary education, the Austrian school system is divided into two main branches: compulsory secondary school and lower-level academic secondary school. However, the science curriculum is the same, with only minor differences between branches.

Like the mathematics curriculum, the science curriculum is organized to have a mandatory core domain that should take two thirds of instruction time. The remaining one third of the time may be devoted to extension domains dealing with topics not strictly defined in the curriculum or intensifying parts of the core domain, such as relating student learning and thinking to situation-oriented education events, different ways of learning (e.g., discovery, project-based), and meaningful linkages of cross-cutting aspects of subjects.

Science is divided into several subjects in lower secondary schools. In Grades 5 to 8, students are taught biology and environmental education as well as geography and economics, including geological topics contained in TIMSS. Students have physics classes in Grades 6 to 8 and chemistry classes in Grade 8. However, school autonomy allows each school to adjust these regulations according to their school profile, although complete cancellation of a subject is not allowed.

Biology and environmental education mainly cover human beings and health, animals and plants, and ecology and the environment. Topics include the following:

- human beings and health: an overview of the structure and functioning of the human body, organs, movement and health, sexuality, and the effects of microorganisms and the ecosystem on human health
- animals and plants: the structure and function of local animals and plants, specifically vertebrates and spermatophytes (Grade 5); invertebrates, spermatophytes, cryptogams, fungi, microorganisms, and the cell as the basic unit of living things (Grade 6); crops and livestock, and evolution (Grade 7); the roles of organisms in ecology, specifically in urban ecology, and heredity and possible uses, e.g., in genetic engineering (Grade 8)
- ecology and the environment: basic ecological terms; positive and negative outcomes of human acts; environmental problems, protection, and conservation (Grade 5); forest ecosystem, national water ecosystems, and environmental issues (Grade 6); soil ecosystems and agricultural ecosystems (Grade 7); ecosystems, ecological niches, and cycles of matter (Grade 8)

Geography and economics mainly cover the diversity of human life and economies on Earth. Using globes and maps, students learn about the lives and economies of people in different areas, reactions to natural disasters, use of natural resources and energy, economic systems, climatic conditions, living in urban communities, the production of goods in industrial and commercial enterprises, fields of services, and Earth as a living and economic area. So there is obviously a strong focus on economics topics not covered in TIMSS. In Grades 5 and 6, the subjects mainly cover the social, economic, and ecological boundaries of our world, which also include climate and the impact on ecosystems, focusing on Austria and Europe. In Grade 7, the topics cover the differences between natural and human-engineered environments, the working environment, occupational and professional facts, unemployment, and financial skills. Grade 8 is dedicated to globalization, political and economic systems, and urban living.

Physics (taught in Grades 6 to 8) gives students a general understanding of the physical thought model (real world – model – model characteristics – real world).

Physics topics in Grade 6 include the following:

- the difference between physical thinking and nonphysical thinking
- facts hindering or supporting movement, including force, mass, inertia, weight, and friction
- the particle model and its effects on solid properties, such as the structure of solids, and heat phenomena; the development and dispersion of sound; swimming, floating, and sinking of solids in water
- flying and the principles of aerodynamics

Physics topics in Grade 7 include the following:

- thermal activity in the living and inanimate world; heat conduction, heat flow, and heat radiation to understand global or local weather
- electrical procedures; voltage, electrical circuits, direct and alternating current, amperage, and resistance
- the construction and effects of electrical equipment, the importance of safety, and economic and ecological impacts

Physics topics in Grade 8 include the following:

- production, transport, and consumption of electrical energy; the relationship between electrical and magnetic energy; magnets; dangers of electrical current
- formation and dispersion of light, formation of natural colors, functioning of optical devices
- the effects of forces, e.g., centripetal force, gravitational force; the movement of objects on Earth and in space
- procedures in the atomic nucleus; causes of radioactivity, radioactive decay, and the basics of nuclear fusion and fission

Chemistry is taught in most schools in Grade 8 only and includes the following topics:

- classification and characteristics of materials, different materials and separation processes, particle and atom structure, the periodic table, chemical bonding as a prerequisite for the diversity of matter, basics of structures of inorganic and organic matter
- basic patterns of chemical reaction, including attributes of acids, bases, and salts, and reaction of acids and bases; oxidation and reduction; connection between material and energetic changes through segmentation and composition of bonds
- sources of raw materials and their responsible use, specifically air, water, and soil and their fundamental importance for life; waste, disposal, and recycling
- biochemistry and health education; food, medication, and drugs; dangers in handling everyday chemicals and precautions

Teacher Professional Development Requirements and Programs

Professional Development Requirements

For teachers who started their service before the 2013–2014 academic year, a distinction is made between federal teachers and provincial teachers (compulsory schools): Provincial teachers are required to attend 15 hours of professional development programs per school year, while federal teachers have no requirements for professional development.

In 2013, a new service law was passed that puts federal and provincial teachers on equal footing: All new teachers for primary and secondary schools are now required to complete professional development programs in the amount of 15 hours per school year. In-service training should generally take place during nonteaching time and may only be associated with the absence of teaching if there is an important official interest.[8] During the transition period, new teachers could still choose between the old and the new law, but as of 2019, all new teachers must adhere to the law that was adopted in 2013.[9]

In-service training is provided by university colleges of teacher education. Every teacher must attend professional development activities; however, the topic or course is not mandated. Teachers may choose on their own from a variety of courses.

Ongoing Professional Development Programs

The development programs for practicing teachers vary each school year. An evaluation of the development programs in academic year 2021–2022 pertaining to mathematics and science shows the presence of numerous offerings, both for primary and compulsory secondary schools. A total of 15% of the in-service trainings in mathematics deal with the national testing program (iKM^{PLUS}). In addition to in-service trainings on various curriculum content, topics such as competence-oriented teaching and dyscalculia are covered.

The main topics of the in-service trainings in science in primary school are topics of the integrative subject *Sachunterricht*. In compulsory secondary school, the most frequently offered courses cover topics from biology and physics. In Austria's professional development programs, the topic of STEM (science, technology, engineering, and mathematics) is increasingly emphasized.

Monitoring Student Progress in Mathematics and Science

National standardized tests (*Bildungsstandardüberprüfungen*, BIST-Ü) were administered in Austria from 2012 to 2019 in mathematics and German in Grades 4 and 8, as well as in English as the first foreign language in Grade 8. However, the results were mainly used for monitoring at school, class, and system levels and only marginally for reporting of individual students' competencies.[10] This monitoring system was under revision from 2019 to 2021. Starting with academic year 2021–2022, the new nationwide standardized tests (*individuelle Kompetenzmessung PLUS*, iKM^{PLUS}) were implemented in primary schools and in 2022–2023 in lower secondary schools. Students' achievements in mathematics, German (reading), and

English (receptive skills) are now assessed annually in Grades 3 and 4 (paper based), as well as in Grades 7 and 8 (online). The test is administered by classroom or subject teachers; therefore, results are available almost immediately (except for open-ended formats requiring manual scoring). The primary focus lies on the formative aspect of testing, that is, information for teachers about students' competencies and information for students about their achievement level in comparison to other students. iKM^{PLUS} aims to foster evidence-based development of instruction and a deeper understanding of students' individual competence levels, as well as their progress in the subjects. The secondary focus of iKM^{PLUS} is to provide reliable data for system monitoring without necessitating additional assessments. By using a specifically developed test design, robust data for system monitoring purposes can be derived from the annual assessments. Following a 3-year assessment cycle, data from three consecutive cohorts and assessment years in Grades 4 and 8 are aggregated and yield standardized reports on educational achievement in German, mathematics, and English for respective schools, school authorities, and federal and national governments. The cycle report on competency achievement at the national level is also intended for the public.[11]

Science achievement is not part of the national standardized assessments but is monitored by teachers as part of instruction. In science, work is often hands on, and progress may also be monitored by the development of students' workpieces.

In addition, teachers monitor student progress in class in a variety of ways, including observation of participation in the classroom, homework, and results of tests and examinations.

Special Initiatives in Mathematics and Science Education

Mathematics and science are seen as key competencies for meeting the societal challenges of digitalization and climate change. Therefore, in addition to established initiatives such as IMST (*Innovationen Machen Schulen Top*)[12,13] or the STEM Seal of Approval (*MINT-Gütesiegel*),[14] new initiatives have been launched in recent years to promote students' interest and competence in STEM subjects. As of the academic year 2022–2023, the subject basic digital education has been compulsory in all lower-level secondary schools. In addition, the newly established STEM middle schools (*MINT-Mittelschulen*) are a joint initiative between the Ministry of Education, Science and Research and the education directorates of the nine federal provinces. These schools have created another focal point in the education landscape, with their own STEM curriculum and a transdisciplinary subject called STEM (*MINT*, or *Mathematik, Informatik, Naturwissenschaft, Technik*). After being tested in a school trial—and incorporating the results of the accompanying evaluation—the MINT secondary schools will be part of the regular school system as another form of school with a specific focus.

Furthermore, many university colleges of teacher education offer specific teacher training courses on STEM, both for preservice and in-service training. Courses may also target a wider audience than teachers, usually in cooperation or by networking with regional governments, universities, and other governmental, nongovernmental, or private partners. There is also a

wide range of special initiatives of shorter duration, such as an annual award for media literacy; annual competitions in mathematics, physics, chemistry, and computer science in preparation for international Olympiads; and projects with a mathematics, science, or computer science theme like the annual IMST awards.[15]

In Austria, the rather large gaps between student subgroups in terms of competencies in mathematics and science are still a cause for concern. Several studies, beginning with TIMSS 1995, showed gender differences in mathematics, science, and technology. The results from the Programme for International Student Assessment (PISA) show that girls tend to show lower competencies in science and mathematics and are less interested in learning mathematics and science.[16,17] National assessments in mathematics also show a large gender gap from Grade 4 on.[18,19] Therefore, a particularly important aspect of education in Austria is the promotion of MINT subjects geared toward girls and women. Most MINT initiatives stress the support of girls to generally enhance the interest of girls in these subjects, plan a career in MINT-related areas, and foster science careers of women by presenting role models and specific grants for young female researchers. The Austrian action plan Join in STEM: BMBWF Action Plan for more STEM Experts[20] addresses these issues, as no STEM talent should be lost along the education pathway, neither at the transition from the lower to upper secondary level nor at the transition from school to university. Increased cooperation between educational institutions at these junctions will facilitate a sustainable STEM education path, e.g., by coordinating the requirements in physics, mathematics, and computer science across all education levels.

Suggested Reading

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