

A Parents' Guide to Careers in Science, Technology, Engineering and Mathematics



 **inGenious**



 European
Schoolnet



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rue de Trèves 61
1040 Brussels
Belgium
www.europeanschoolnet.org

Author Mike Stone

Editors Rinske van den Berg
Valentina Garoia
Liesbeth Reynders

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What is STEM – and why is it so important?

Science, Technology, Engineering and Mathematics (STEM) are not as popular in Europe with school-age students as they once were. That's a concern for Europe as a whole – but it should be a concern for parents, too. Why? Because any future skills shortage will affect both the economy and the individual worker.

Think about the modern world. Look around the room you're in. Pretty much everything, from the laptop or tablet or PC you're reading this on and the software that runs it, to the paint or wallpaper on the walls, the fibres your clothes are made of and even the food you serve the family pet, is at least in part available due to the efforts of scientists, researchers, engineers and technicians who all have STEM skills.

Without enough of these people, the economy just won't function as well as it could. And according to many studies, that's exactly what Europe is facing. Falling numbers of graduates with STEM qualifications plus the imminent retirement of STEM specialists means that there are big shortages on the horizon.

An opportunity and a threat

It's no surprise, then, that STEM graduates are in demand. STEM professionals command attractive salaries, benefits and travel opportunities. Not only that, but STEM-qualified workers are finding their way into an increasingly diverse number of positions and sectors.

And given future projections, it looks as if those benefits will only grow and the opportunities will become increasingly diverse.

On the flipside of all this future opportunity is a threat. As the world becomes a more technological place and more of the economy becomes science and IT-based, workers of the future will need increasing STEM skills to be able to compete in the labour market of tomorrow.



$$y = x^2$$



So what's the problem?

If getting a job in science, technology, engineering and mathematics is such a wonderful proposition, why aren't the subjects needed for a career in STEM as popular as they were? And why isn't every child with even a slight interest and aptitude choosing to study them when they have the opportunity?

There is no single answer to this – but misconceptions about the sort of jobs STEM can lead to and their remuneration, the difficulty of some of the subjects involved and shortcomings in the education system may all play a part, along with peer pressure and a perception that STEM is simply 'boring'. *The report: Overcoming the skills mismatch in STEM: a view from young Europeans* by Think Young and Intel also shows that these perceptions can be strongly influenced by various cultural biases, so the way in which STEM subjects are misunderstood can vary, depending on where you live.

The net result is a generation of children that may be unaware of the rewards and possibilities of STEM, including many young people who doubtless have abilities in the field and who would benefit greatly from studying STEM – and perhaps enjoy a career in it.

The purpose of this e-book

So, the reason for this short booklet is to try and help you as a parent to encourage the STEM talent in your child or children, to suggest ways to maximise their interests in the subjects and – hopefully – to improve their chances of obtaining STEM qualifications, which could lead to a STEM-related career.

What this booklet is not here to do is try and cajole you or your offspring into taking up a career that they have no interest in or aptitude for. We feel that many children are not so much ignoring STEM, they are simply unaware of the possibilities studying those subjects has to offer. Further, we believe that the vast majority of children can find STEM-related topics stimulating and useful, and that an inquiring, scientific mindset is an asset in any occupation, even if a final career in STEM is not for everyone.



De-mystifying STEM

Lack of good information on STEM-related jobs in schools is another reason we published this book. As an example, according to a 2011 survey conducted by the CBI, a UK employers group, nearly half (43%) of 16-18 year olds in the UK feel they received poor advice or none at all from a careers service.

Furthermore, according to Engineering UK and the Institute of Physics, traditional careers information, advice and guidance can act as a barrier to girls taking an interest in STEM careers, by continuing to reinforce gender stereotypes.

The 2011 *Girlguiding UK* survey found that 43% of girls said they were put off science and engineering careers because they did not know enough about the kind of careers available. 60% said they also were put off by a lack of female role models. Women and girls in STEM is also an issue we address in this document.

Advantages of a STEM career

We've already touched on some of the reasons why a career in STEM could be an attractive one to a young person currently in education. Here is a handy list with some supporting facts and figures to help explain the case further.

Opportunities are growing

Employment in STEM occupations is projected to grow almost two times faster than the average for all occupations. The numbers break down as follows:

- ↗ All occupations (European average): **10% growth**
- ↗ All STEM occupations: **19% growth**
- ↗ Life science occupations: **27% growth**
- ↗ Computer and mathematical jobs: **22% growth**
- ↗ Physical science jobs: **15% growth**
- ↗ Engineering positions: **11% growth**





$$\frac{a}{\sqrt{b}}$$



To put one of these figures into context, the European Union calculates that by 2015 there will be a shortage of over half a million Information and Communications Technology (ICT) workers in Europe.

Competition for jobs is decreasing

The European Union would like to see 40% of its citizens getting STEM qualifications at college or university level, in order to plug the current skills gap. In fact, during the last decade the number of STEM graduates has actually fallen to around 17%, putting us behind China, India and Japan.

Although the EU is making every effort to reverse this trend, it seems that at least for now, what is bad news for the employer is good news for the graduate. This situation is made worse – or better, at least from the point of view of potential STEM professionals – due to Europe being unable to attract highly skilled graduates from outside the EU and with a large wave of STEM-related retirements that will take place soon.

STEM opens many doors

Technology and STEM skills are crucial to the modern world – and will only become more vital with the advent of new technologies such as renewable energy, nanotechnology and many more.

As we'll see in later sections, the range of STEM-related jobs and careers is very broad indeed. What's more, STEM skills are likely to widen your child's options later in life, rather than narrow them. Many careers will be open to someone who continues with STEM subjects after 16, but someone who avoids STEM subjects past that age will probably find that it is very difficult to go back and study them later on. In addition, it's fair to say that science and mathematics are valued and useful for the majority of careers and that they are not in any way limiting.

STEM jobs are well-paid jobs

Generally speaking, across Europe STEM careers provide good salaries later in life. This can be a particularly important issue if you live in a region where your child is likely to incur further education fees and wants to go to university. As an illustration of the figures involved, this [PriceWaterhouseCoopers report](#) shows that chemistry and physics graduates in the UK will earn on average over 30% more during their working lifetimes than workers who chose to study other, non-STEM subjects.

Myths about STEM

It's an unfortunate fact that schoolchildren often see STEM subjects at school as boring, difficult to understand and irrelevant to the real world or their everyday lives. In addition, many young people feel that their desire to contribute to society in a meaningful way will not be best served by a career in STEM. This is despite the fact that a STEM career is one that can genuinely help to make a positive difference.

Research shows that there are a number of reasons for these misconceptions – and that steps can be taken to overcome them. Let's look at each issue in turn and what can be done to alter your child's perception of it.

STEM classes are difficult

The problem many children encounter with STEM classes is often more to do with the way the subject is taught, rather than the course content itself. For example, over-emphasis on the recall of facts instead of applying critical thinking.

Modern teaching methods emphasise the scientific method of observation and experimentation, and collaboration in learning. This [inquiry-based learning](#), which is increasing in popularity across Europe, is much more likely to bring a subject to life.

In addition, many of the concepts involved in science are dynamic. And whilst that makes them potentially more interesting than other subjects, they are difficult to teach through a typical textbook approach. However, with the advent of more interactive and technological teaching tools – many of which we will introduce in this booklet – the classroom can be the place where these 'dull and difficult' subjects really come to life.

STEM careers are boring

This prejudice couldn't be further from the truth. Because although – like any job – there are aspects of some STEM positions that are routine and repetitive, STEM careers are as varied and broad as any. As discussed in the introductory section, a job in STEM could involve anything from green technology to designing consumer electronic goods and formulating a new chocolate snack. Surely, within a range of disciplines and sectors this diverse, most children with an ability for STEM could find an interest?





STEM is strictly academics only

As the technological world marches ever forward, it moves ever further from academia. Although a university- or college-based career may be what your child is looking for, alternatives beckon in a vast array of applied jobs bringing the benefits of communications devices, revolutionary medicines, best-selling apps, movie special effects, and so much more.

In STEM, a degree is vital

Although many STEM careers do indeed require a further education qualification, there are alternative routes into a STEM career. Thanks to the scarcity of STEM skills, some companies will take school-leavers on as apprentices or provide other forms of on-the-job training that can lead into a science or technology career path, for example.

STEM is for men

There is an ongoing misconception that STEM jobs, particularly in engineering, require some form of heavy labour. It's myths like this, plus – until recently – the lack of female role models, that have historically put girls off STEM. But things are changing.

STEM careers lack creativity

So much of STEM revolves around innovation – and the scientific method itself would be impossible without making great leaps of the imagination. Without imaginative individuals and creative thinking, STEM would not be fulfilling its role.

Something to say about working in STEM

There are a huge number of role models who have made a career in one or more STEM subjects. Here are just a few, that hopefully illustrate the wide range of people enjoying a diverse selection of STEM-related occupations.



Professor Brian Cox TV's STEM evangelist



"It is important for everyone to know a bit about the scientific method."

Brian Cox has done more than most scientists to popularise STEM subjects for the general public and young people in particular. From being a pop musician and now a TV presenter, Cox is also a serious scientist and researcher who studied physics at university.

He is also highly committed to involving more children in STEM subjects. Cox's advice to encourage interest includes highlighting the variety of fascinating careers available, such special effects in movies, Formula One car racing and space travel.

[Read a great interview](#) with Prof Cox where he gives advice to children, parents and educators on progressing in STEM subjects and careers.

Neil Gilmour

A geology student is now a Vice President at Shell



"I still pick up rocks whenever I'm standing on a beach and wonder where they've come from."

Neil Gilmour explains how an inspiring geology teacher led him to do a degree in the subject, after which he joined Shell and worked on exciting projects all around the world, before gaining a top position at one of the world's biggest oil companies. [Read more](#).

Johanne Smith

Inspired by a group for women, she now helps fuel the world's cars



"At the end of the day, a strong team comprises a mix of both men and women."

Johanne Smith develops the latest fuels for Shell and promotes them around the world. Her interest in engineering and science began at secondary school, in part because of her involvement with WISE (Women in Science and Engineering). [Read more](#).



How seven young people went from science studies to careers in BASF



"I have gained valuable insights into a wide variety of areas and worked with many colleagues from a huge range of disciplines."



From human nutrition to communications technology, automation technology and marketing, there are many STEM paths in the real world of work. Here's a great site where you can [read more](#) about them.

Philips's employees explain why they have STEM careers



"I can see my design, it goes around the world and touches people's lives." Chee Keong Ong talks about his role as Chief Engineer Thermo-Mechanical Development.

"I have the freedom to create. What I create will ultimately, hopefully, impact people's lives."

Sabrina Khoo talks about her role as Chief Engineer Chemical Developments.



"I am proud of seeing my work, ready to use, ready for that next life to save."

Tanya DeSchmidt talks about her role as a Quality Engineer for Philips Automated External Defibrillators. Why not [watch interviews](#) with some of these enthusiastic STEM professionals?

35 inventors under 35

From Wi-Fi tracking to better computer chips and healing hearts to more effective ways of working, these younger innovators each have an [inspiring story to tell](#).

Real-world careers in STEM

What job might your child consider in science, technology, engineering or maths? The sheer range of career paths and occupations open to an individual with STEM studies and training is far too wide to cover all the options open to them here, but the following links should at least help you both start exploring the possibilities.

Are they cut out for a STEM career?

Is your child right for a STEM-related occupation? And if so, what type? It's often difficult to be sure, but here's a fun [interactive quiz](#) from The Big Bang Fair that will help them think about the issues involved – and maybe even help make a decision on what they might want to do in the future.

Science

The [All About Careers site](#) has a great [Science section](#) that allows you and your family to explore different career paths from Food Sciences to Particle Physics, Polymer Chemistry to Veterinary Science.

The [FutureMorph](#) site has a comprehensive range of resources for anyone interested in a STEM career. Its science section is broken down into:

▶ [chemistry](#)

▶ [biology](#)

▶ [physics](#)

Technology

A large number of technology jobs are in the field of IT. The following links to the [BigAmbition](#) site provide alternative names for specific positions, a general overview of the duties, skills and aptitudes needed, salary expectations, plus video interviews with people currently working in the job:

▶ [Games developer](#)
▶ [Multimedia producer](#)
▶ [IT Project Manager](#)

▶ [Programmer](#)
▶ [Software Engineer](#)
▶ [Tech Support](#)

▶ [Web developer](#)
▶ [Systems Analyst](#)
▶ [Tech Consultant](#)



Here are additional resources to help you and your family better understand some of the key positions that are generally available in the ICT job market.

- ▶ [IT Manager job description](#)
- ▶ [Data Analyst job description](#)
- ▶ [What does a SAP Consultant do?](#)
- ▶ [IT Director job description](#)
- ▶ [How to get a job in cyber security](#)
- ▶ [Becoming an ICT Technician](#)
- ▶ [What is a Business Analyst?](#)
- ▶ [IT Support job description](#)
- ▶ [What does a Software Developer do?](#)

Steph

User Experience (UX) Developer at Microsoft

"My typical day is spent coding, even though before I started here I couldn't code at all!" says recent graduate Steph. Find out more about her job [here](#).

Noah Levin

Interaction Designer at Google

After working at Google for only a few months, Noah improved Google Search for iOS. Hear his story and about the employee culture that allowed him to do it [here](#).

ENGINEERING

[What is engineering?](#) FutureMorph asks what do engineers do and what do all the different types of engineering mean? More importantly, would you like it and where can you find out more?

[All About Careers Engineering](#) looks at a wide range of representative engineering positions, from engineering in the food and drink industry, to aeronautics, chemical engineering and much, much more.

MATHEMATICS

[The Institute of Mathematics](#) has sections for different age groups: 11-14, 14-16, 16-19, plus undergraduates. Here you can find career profiles, background on the real-world relevance of studying maths, plus lots of maths-based puzzles and games.

[Careers from Maths](#) gives an overview of the subject's applications in the real world, advice from employers and profiles of a whole range of maths graduates who describe what they actually do.

STEM for girls

Katja, Director of Components Supply, Austria.

"I am talented in both mathematics/physics and in communications. And I would like to use future-orientated technology in simple and secure applications to the benefit of humankind."

Sofie, Market and Technology Manager, Belgium.

"An industrial career opens a lot of opportunities for training, diversification and ...development."

Jaroslava, Head of the Department of Genetic Resources, Czech Republic.

"Personally, I do not have any problems balancing my private life and my career."

Role models

That women and girls are under-represented in STEM subjects and careers is an undeniable fact. In Europe, 55% of all students are female, but only 37% of all students enrolled in the science, mathematics and computing fields are women. However, this does not mean that STEM is a men-only career option.

Recent [research](#) has shown yet again that the problem of attracting women into STEM is cultural, not biological. To quote Professor Gina Rippon: **"We really cannot afford to sit back and accept the 'essentialist' view that girls are not going to be interested in science subjects because of some 'brain deficiency'"**.

One of the key reasons given for girls to decide against STEM at a fairly early age is a lack of role models. For profiles of many inspiring European women doing real jobs in science and technology, see [the FEMtech website](#), which is in German.





Here's an inspiring young woman who is building an app to encourage people to recycle more. 14-year-old Zea explains why being a geek is cool and how tech has changed her ideas about the future in [an article](#) from the UK Guardian newspaper.

Avoiding macho examples in STEM

It's a sad fact that another reason for girls avoiding STEM is that the context given for a lot of science and technology classes is male-orientated. The links below are for sites and resources that help break through some of the stereotypes and provide a more female-friendly environment for girls interested in STEM.

[The Stemettes](#) is a community website that is showing the next generation that girls are doing science and ICT too. It organises live events such as hack-a-thons and offers careers advice.

[Deployons nos elles](#) is a French language educational project dedicated to overcoming gender stereotypes in STEM-related careers and encouraging young women to enter them.

[Elles Bougent](#) is another French initiative and is dedicated to developing girls' interest in engineering and technology.

[VhTO Beeldenbank](#) is a Dutch project aimed at girls cultivating an interest in ICT.

[Little Miss Geek: Bridging the Gap between Girls and Technology](#). An inspirational book for the next generation of young girls to encourage them to become technical pioneers.

[GirlGeeks](#). An online community for women and girls interested in technology and computing.

[Women@Google website](#). Includes video profiles of women working successfully in technology.

[WomenAtMicrosoft](#) facebook page. Lots of links to stories about female role models.



Lessons from school

Of course, your child's main STEM input is likely to come from their experiences at school. As a parent with a child with STEM ambitions, it's a good idea to get as involved as you can with those experiences. Here are a number of steps you and your child can take to do just that.

Getting involved at school

Here's what Tullia Urschitz, a maths, science and ICT teacher from Italy, had to say on the subject of STEM, parents and children:

"In my experience, if you want parents to be involved with what students do – from their STEM subjects at school to how they use their smartphones and the Internet – you can't just tell them about it, they actually have to get involved."

As an example, we had a workshop where students had to teach their parents the fundamentals of [Scratch Programming](#) and its uses.

Showing is always better than telling – and involvement is even more effective. It's certainly worked with several courses we've done."

Does your child's school do these sorts of parent-child activities? If they do – get involved. If they don't – suggest they could and offer to help organise them. And if you don't know – we suggest you find out!

Learn the curriculum, stay in touch

Keeping track of your child's progress is a lot easier if you are aware of what they need to achieve to pass exams and successfully pass courses. Get hold of the curricula they are using. Take a look at their textbooks. Discuss any issues with their teachers at open days and parents' evenings.



Homework is also your work

Don't worry – we're not suggesting you do your kid's homework for them. However, it is a good idea to be familiar with what assignments they are being set and how they are being tackled. Of course, the better you know the curriculum and understand the subject matter, the easier that will be.

Visit the inGenious practice gallery

inGenious is the European Coordinating Body in STEM Education, which has the aim of improving the image of STEM careers among young people. The initiative has a huge range of useful resources and, although it is primarily aimed at helping STEM teachers with their curricula, its database of activities – known as the practice gallery – is also really useful for parents and children.

The activities – or practices – have all been designed to engage students in different aspects of STEM, often by turning subjects as varied as deforestation, truck design and earthquakes into highly engaging games. There are also workshops, events, presentations and visits to get involved with. Practices are available in a wide range of languages and you can also search the database by age range, category of activity and educational level. Take a moment to visit the [inGenious practice gallery](#).



Which skills should a STEM student develop?

If your child wants to be involved in STEM, there are a number of skills it would be a good idea to help them cultivate. Without the correct skills, anyone would find the challenges of STEM at school or university very severe. With them, their possibilities for success would be far greater.

Perhaps the most important skill is also a STEM subject itself. Across most of Europe, one of the major stumbling blocks to STEM success is lack of ability in maths – regardless of the actual subject being studied. Remember this if your child tries to convince you that maths has nothing or little to do with their chosen subject and do all you can to cultivate mathematical skills in your offspring. For some helpful ideas on how to do this, see the STEM At Home section, below.

Other useful skills that have been identified are:

- **Problem-solving** – being able to define questions and problems, design investigations to gather data, then collect and organise data, draw conclusions and then apply what they have learned to novel situations.
- **Innovation** – how to creatively use science, mathematics and technology concepts learned in the classroom by applying them to real-world situations.
- **Invention** – recognising the needs or problems, then creatively designing, testing and implementing solutions to solve them.
- **Self-reliance** – being able to use initiative and self-motivation to work alone, develop and gain self-confidence, and work within a time limit.
- **Logical thinking** – being able to apply the rational and logical thought processes of science, mathematics, technology and engineering design to innovation and invention.
- **Technological literacy** – this is all about understanding and explaining the nature of technology, developing the skills they need and applying technology appropriately.



STEM in your home

Sally Reynolds

owner of an educational media business



"It often just takes one spark to get a child hooked on a STEM subject. There are so many places to inspire children now, including museums and science centres such as Technopolis here in Belgium, or ESERO (European Space Education Resource Office) across Europe, that are terrific to take kids to. Don't just leave it to schools to take them there!"

Jacinta Burke

secondary school science teacher in Ireland



"One way you can interest young kids is to link science with stories they know, like the tale of Alice in Through The Looking Glass or Goldilocks and the Three Bears. The first we used to talk about light and mirrors, and the second about heat."

We described how Giotto designed the Munich stadium thanks to his study of bubbles and surface tension – and of course surface tension can lead you into nanotechnology... So everything is connected to the everyday and that's the point you have to illustrate to spark interest."

There is so much that you can do to encourage and cultivate an interest in STEM subjects at home. Here are just a few ideas:

Go to museums, science centres and exhibitions. Many, many museums now have special child-friendly exhibits and interactive activities. If you don't already know, find out where your nearest museum is and get on their mailing list, so that you know when a potentially interesting event is going to come up.

Become a domestic expert. Encourage by example! Try and keep up-to-date with newsworthy STEM issues – such as the human genome project, Large Hadron Collider, space missions and so on, then try and stimulate discussions in the family. Also, the next time your child asks you a tricky science question, you'll be prepared.

Ask and explain. How does the light come on? Where is the Internet? How does the toilet fill up after you flush it – then miraculously stop? There are so many things around the house, in the garden and day-to-day life to keep an inquiring mind active indefinitely. As a parent with a STEM aspiring child, it's a good idea to ask the questions – and be able to answer them if your kids can't.

Online activities and more

If you're having trouble being inspired to be inspirational, don't fear – there is a staggering range of STEM resources for parents and children just a few clicks away. Here is a selection, with a brief description for each.

[Future Morph parents](#) is a comprehensive website for parents that contains a wealth of career advice, general background on STEM subjects, information on getting work experience, plus a whole lot of games.

[The UK Met Office](#) website has a range of weather-related experiments and activities, aimed at both teenagers and younger children. Ideal for rainy days stuck at home!

[British Science Association](#) has hands-on activities for the home, quizzes and a guide to local STEM-related events.

[The Science Museum](#) has a wide selection of games for different ages, available in English, Spanish, French, Italian and German. It also contains invaluable information for planning a visit, if you're intending to go.

[Shell](#) has a number of STEM-based activities for children.

[The Science Council](#) has a list of 10 activities especially designed for the holidays, plus a whole selection of background on science-related matters.

[Planet Science](#) has dozens of experiments and activities grouped into categories such as Chemistry Chaos, Magic Tricks, Outdoors, Surprise and Messy. You have been warned.

[The Numberline](#) creates a dynamic environment in which you and your child can explore numbers and the relationships between them.



[The Mathematical Toolkit](#) is the result of a collaboration with the UK Mathematical Association and is designed to support the teaching and learning of mathematics for pupils at UK Key Stage 3.

[Mental Maths](#) features simple step-by-step tools to help children learn to solve complex calculations quickly and accurately.

[GeoGebra](#) is part of the Microsoft Educator Network and offers free dynamic mathematics software for all levels of education that brings together geometry, algebra, spreadsheets, graphing, statistics and calculus in one easy-to-use package.

[Math Worksheet Generator](#) creates multiple maths practice problems, from basic maths to algebra, in seconds. You provide a sample problem and it does the rest. It even gives you an answer sheet.

[Mathematics 4.0](#) is a powerful computer algebra system that has a friendly user interface and a step-by-step equation solver, helping children understand the path to a correct answer.

[Jumpido for Windows](#) is a free download from a Bulgarian startup company. It uses Microsoft Kinect to put the fun back into maths with game-based learning for primary school children.

[Mathematica for Primary and Secondary Education](#) has downloadable demonstrations, courses and other learning resources for Mathematica, Wolfram's computational software programme based on symbolic mathematics.

[9 Incredible Science Projects by Brilliant Kids](#) details some fascinating projects being undertaken by schoolchildren, that range from hi-tech glasses, to a great way for helping the aurally-impaired to enjoy music.

[The Naked Scientists](#). Don't worry – there's no nudity on this site, just lots of fascinating facts and practical, kitchen sink experiments to enliven a dull day, from Cambridge University.



A final word

If you've made it this far, you'll know that there are a number of challenges that face European society, its educational systems and – most importantly – its young citizens, regarding STEM subjects.

Hopefully, what you've also realised is that these challenges are by no means insurmountable and, if you are the parent of one or more of these young people who have an aptitude for science, technology, engineering and maths, there is much you can do to nurture and guide their interest in a way that will be helpful to both their school life and their future career.

But perhaps we haven't emphasised enough that, whatever your child's chosen path, a greater understanding of STEM subjects will better equip them for adult life. There are, of course, obvious career advantages in having a better understanding of today's technological world.

In addition, a better understanding of the concepts that lie behind issues such as global warming, stem cell research and renewable energy will allow the next generation of citizens to make more informed decisions about corporate, state and global policies.

Whatever the choices you and your child make, we hope that you have found this short booklet informative and useful, and will be able to put some of its advice and insights into practice.





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