

# RS/JMC Report on teaching and learning geometry 11-19: overview and discussion

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5th British Congress of Mathematics Education (BCME5)

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## Teaching and Learning Geometry 11-19

- Report of a Royal Society/JMC working group
- Chair: Professor Adrian Oldknow
- Publication date: 27 July 2001

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Geometry and algebra are the two formal pillars of mathematics.

Understanding, and making sense of, the world that we see is a very important part of our evolution. Therefore spatial intuition or spatial perception is an enormously powerful tool and that is why geometry is actually such a powerful part of mathematics - not only for things that are obviously geometrical, but even for things that are not. We try to put them into geometrical form because that enables us to use our intuition. Our intuition is our most powerful tool.

Sir Michael Atiyah, OM, FRS, C.Math, FIMA

Quoted in Chair's preface to the report

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The working group had the following terms of reference:

1. To make recommendations about teaching methods and the content of the curriculum with relation to the topic of geometry taught to pupils aged 11 to 19, in order to inform discussions of any future curriculum revisions;
2. To take into account evidence about current competence and future needs in geometry among different groups of pupils;
3. To examine the influences on pupils' experience of geometry within all aspects of the pre-university education system, including vocational provision.

The working group consisted of 15 members, plus 3 'observers' from other organisations.

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What we seek is a coherent, stimulating, rewarding and challenging geometry curriculum which is taught in a way which captures students' interest and imagination and which attracts them towards mathematics as a subject for further study. The achievement of our vision requires a significant improvement in the quality of teaching, and that has major consequences - both for the continuing professional development of teachers and for the provision of high-quality supporting resources.

Chair's preface to the report

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The structure of the report

- Geometry and its teaching and learning

- The place of geometry in the curriculum

- The 11-16 geometry curriculum

- The development of the geometry curriculum

- Allocation of status and time for geometry

- Geometry 16-19

- The role of assessment

- The teaching of geometry

- Improving the take-up of mathematics

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## Appendices

- National and international contexts for mathematics
- Some recent government initiatives in education
- Expectations of geometry in education
- Geometry in history and society
- Geometry in the current 11-16 curriculum
- Geometry in the Key Stage 3 mathematics strategy
- Spatial thinking and visualisation
- Proof – Why and What?
- Examples of applications of geometry
- 3-dimensional geometry
- Frameworks for developing schemes of work for the curriculum
- Integrated approaches to geometry teaching

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## Conclusions:

For pupils aged 11-16, the geometric content of the new National Curriculum, with a few adjustments, forms an appropriate basis for a good geometry education.

In order for this to be achieved considerable changes are needed in the way geometry is taught.

It is vital that those working to improve mathematics education ensure that their work contributes significantly to improvements in geometry teaching.

Bringing about improvements in geometry teaching will require a significant commitment to a substantial programme of continuing professional development alongside the development of appropriate supporting materials.

Post-16, there are insufficient opportunities for students to build on their 11-16 studies in geometry.

Those concerned with curriculum design need to review the structure of post-16 qualifications in mathematics to ensure they provide improved opportunities for students to continue to study geometry.

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The most significant contribution to improvements in geometry teaching will be made by the development of good models of pedagogy, supported by carefully designed activities and resources, which are disseminated effectively and coherently to and by teachers.

The successful implementation of the Ma3 component in the classroom will only be successful if teaching programmes are focused, coherent and develop links within geometry and mathematics generally where appropriate.

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We regard it as vital that pilot studies should be carried out without delay to identify and enhance good practice in the teaching of geometry.

At the same time planning should take place for a national system of provision for CPD in geometry and its teaching. This could be within the framework of the Key Stage 3 strategy.

One idea which has received some support is the provision of two week geometry summer schools for serving teachers, teachers currently in training and those about to embark on a course of initial teacher education (ITE).

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New graduates entering courses of initial teacher education (ITE) have very varied backgrounds in geometry. Many will have experienced little, if any, geometry at sixth form or university level.

Within the current statutory curriculum for the initial training of secondary mathematics teachers there is little scope to provide the rich overview of geometry that we believe is essential for effective teaching.

So it is important that, in parallel with developments in CPD to support the teaching of geometry, there is a recognition of the need to improve the geometric background of those intending to enter mathematics teaching during, or before, their initial training.

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In order to support the developments in the effective teaching of geometry which we seek there is a need for a variety of materials in both printed and digital form, as well as resources such as models, posters, activity kits, videos, libraries of digital images, computer software and the like.

We would like to see the funding to schools for ICT being used more effectively to support the geometry curriculum.

The mathematics professional associations have a key role to play in all of these developments in partnership with the newly formed General Teaching Council (GTC) and other bodies such as the Royal Society, Higher Education Institutions, the National Numeracy Strategy, Ofsted, QCA, TTA and BECTa.

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Comments and discussion invited!

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Thank you!

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