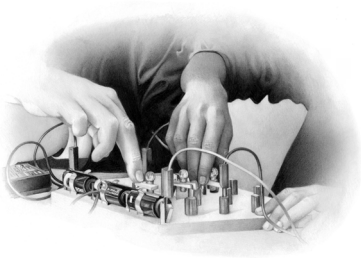
GOOD PRACTICAL SCIENCE

JOHN HOLMAN



HANDS-ON PRACTICAL WORK IS AN ESSENTIAL PART OF LEARNING SCIENCE, AND IT ALSO DEVELOPS VALUABLE SKILLS AND ATTITUDES. OUR 10 BENCHMARKS DEFINE GOOD PRACTICAL SCIENCE AND INCLUDE CRITERIA TO MAKE EACH BENCHMARK MEASURABLE. YOU CAN USE THESE CRITERIA TO SEE HOW YOUR SCHOOL IS DOING AGAINST EACH BENCHMARK

GATSBY

THE BENCHMARKS FOR GOOD PRACTICAL SCIENCE

1	PLANNED PRACTICAL SCIENCE	Every school should have a written policy that explains why teachers use practical science, the outcomes they expect from it and how they achieve those outcomes. The process of producing the policy is as important as the policy itself.
2	PURPOSEFUL PRACTICAL SCIENCE	Teachers should know the purpose of any practical science activity, and it should be planned and executed so it is effective and integrated with other science learning.
3	EXPERT TEACHERS	Teachers should have subject-specialist training (both initial and continuing) in the subject (biology, chemistry, physics etc) and age range they teach, so they can carry out practical science with confidence and knowledge of the underlying principles.
4	FREQUENT AND VARIED PRACTICAL SCIENCE	Students should experience a practical activity in at least half of their science lessons. These activities can be short or long, but should be varied in type.
5	LABORATORY FACILITIES AND EQUIPMENT	Schools should have enough laboratories to make it possible for every teacher to do frequent practical science safely. Each laboratory should have sufficient equipment for students to work in small groups.
6	TECHNICAL SUPPORT	Science departments should have enough technical or technician support to enable teachers to carry out frequent and effective practical science.
7	REAL EXPERIMENTS, VIRTUAL ENHANCEMENTS	Teachers should use digital technologies to support and enhance practical experience, but not to replace it.
8	INVESTIGATIVE PROJECTS	Students should have opportunities to do open-ended and extended investigative projects.
9	A BALANCED APPROACH TO RISK	Students' experience of practical science should not be restricted by unnecessary risk aversion.
10	ASSESSMENT FIT FOR PURPOSE	Assessment of students' work in science should include assessment of their practical knowledge, skills and behaviours. This applies to both formative and summative assessment.

GOOD PRACTICAL SCIENCE IN YOUR SCHOOL

We carried out an international study of practical science in countries where science education is known to be successful. Based on our observations, we developed ten benchmarks that define good practical science in schools.

To test the usefulness of our benchmarks, a survey of English schools was undertaken and whilst meeting all the criteria for the benchmarks is demanding, our analysis showed that many schools are well on their way to achieving them.

The ingredients of good practical science are the ingredients of all good science learning – expert teachers, well-planned lessons and technical support. As such, we believe that a school's progress in improving practical science can best be made by prioritising Benchmarks 1, 3 and 6 because these three benchmarks are strong enablers for others.

It is for headteachers and science heads to take the lead in prioritising practical science, and our benchmarks show what they need to do to ensure it is world class.

THE PURPOSES OF PRACTICAL SCIENCE

From a survey of the literature and of experts in 11 countries, we found consensus on five purposes of practical science.

A
TO TEACH THE PRINCIPLES OF SCIENTIFIC INQUIRY

B
TO IMPROVE UNDERSTANDING OF THEORY THROUGH PRACTICAL EXPERIENCE

C
TO TEACH SPECIFIC PRACTICAL SKILLS, SUCH AS MEASUREMENT AND OBSERVATION, THAT MAY BE USEFUL IN FUTURE STUDY OR EMPLOYMENT

D
TO MOTIVATE AND ENGAGE STUDENTS

E
TO DEVELOP HIGHER LEVEL SKILLS AND ATTRIBUTES SUCH AS COMMUNICATION, TEAMWORK AND PERSEVERANCE

SUPPORT FOR GOOD PRACTICAL SCIENCE

We sent a hard copy of the full report to every school in England. To view the report and full appendices, visit gatsby.org.uk/GoodPracticalScience

Support on meeting each of the *Good Practical Science* benchmarks is available on STEM Learning's web page on the *Good Practical Science* report.

Visit the CLEAPSS website to find out more about their advisory service supporting science and technology in schools.

To find out more about the support offered by the Association for Science Education (ASE), visit ASE's website.

> EXPERIMENTATION GIVES SCIENCE ITS IDENTITY. SCIENCE USES EXPERIMENTS TO DISCOVER THE REALITIES UNDERLYING THE WORLD, AND THIS PRACTICAL APPROACH SEEMS TO BE AS INTRINSIC TO YOUNG LEARNERS AS IT IS TO PROFESSIONAL RESEARCHERS