

The STEM Agenda: Bringing Learning to Life

Oakmeeds Community College,
Burgess Hill, West Sussex

Promethean Education Strategy Group
Curriculum Development





Case Study: Oakmeeds Community College, West Sussex, UK | 1013 students | 11-16 yr olds | Headteacher: Colin Taylor

“The lack of STEM graduates may cost the UK \$100b in lost revenues over the next 30 years.”
Leitch Review of skills, ‘Prosperity for all in the global economy-world class skills’, December 2006.



**A skills based approach:
Learning for the 21st Century**

The desire to inspire young people to pursue Science, Technology, Engineering and Mathematics (STEM) education has never been greater in today’s global world.

It is crucial we all work together in solving the urgent global issues around STEM. Enough research has been done and there have been many extensive pilots and initiatives. The argument is no longer about when or why we should do this. We need more and better prepared scientists, engineers, technologists and mathematicians and we need them now in order for our economies to grow as we move through the third millennium.

Teachers at Oakmeeds Community College are taking significant steps to bring learning to life by engaging students in practical, challenging and exciting learning experiences driven by a strong STEM focus.

For some time the College has been focussed on creating more meaningful learning experiences for the students and supporting the professional development of staff. The College was already committed to the RSAs ‘Opening Minds’ curriculum to support the development of a more engaging and dynamic approach to learning and teaching in Year 7 and now, additionally, in Year 8. As the Headteacher Colin Taylor points out, this was inspired by a firmly held belief that the College needed to move away from a more traditional content driven approach, to one that develops learners’ skills and teachers’ professional practice through more memorable, exciting and project focused activities. Such an approach enables students not only to develop competencies and acquire subject knowledge and related skills, but also enables them to apply these in a more meaningful context. The Headteacher stated that he wanted to drive and embed a similar cross-curricular, skills focussed approach fostered through Opening Minds into STEM teaching and learning.



The STEM Agenda: Bringing Learning to Life

Following the publication of its Science and Innovation Investment Framework 2004-2014 and the 21st Century Schools White Paper, the Government set out its plans to ensure that all students, regardless of background or talent, receive a better and more engaging experience of STEM subjects. Such papers outlined both the need to raise achievement rates for students and also that the future economic success of the UK could be dependent upon a good supply of skilled scientists and engineers.

The College now has an active interest in the STEM agenda, and intends to integrate subject learning through coordinated cross subject activities. Following some early successes with new approaches, the College is developing a STEM enrichment programme. This includes the use of curriculum enhancement days ('flexi-days') that seek to challenge conventional approaches to teaching and develop new and exciting ways of learning. It is hoped that these will help to influence the development of teaching practice across the whole College.

On flexi-days, different year groups undertake a range of 'real' activities focussed on students developing as learners through the application of their knowledge and skills. For example, Year 7 students undertook a design technology based project called 'Just Desserts', where they had to create a dessert, and design and create the packaging. Year 10 students designed and made model wind turbines to maximise electrical output as part of an Eco Friendly Power source activity. Collaborating with the business





sector, Year 9 students were taught to work in teams to create a new product launch presentation.

The Headteacher feels that the STEM enrichment activities relate to two core areas. The College aims to address developing students' critical learning skills and raising student achievement. He feels the two are inextricably linked because if students develop the right skills they can become independent learners capable of higher achievement.

Pip Huyton, an Independent Mathematics and STEM Consultant points out, STEM subjects have traditionally been taught in silos with learning frequently de-contextualised. Content is often duplicated across subjects and remains abstract rather than being dynamically linked and applied through active experiences. Involvement in STEM enrichment projects has helped students become more aware, motivated, active and collaborative. Learning has also been brought into the real world, or perhaps, the real world has been brought to learning.

Huyton points out that STEM based approaches allow teachers to build on their existing knowledge and share the skills and abilities that exist within their subject teams, schools or wider networks. This pool of shared knowledge can be used for project direction and to influence the decision making processes during learning activities. Collaboration and networking are essential to effectively cascade knowledge, share resources, and to help develop a more innovative culture across schools.

STEM in action: Rocket Propelled Cars & the Bloodhound Project

A recent STEM enrichment day, led by Pip Huyton, involved a group of Year 9 gifted and talented students from Oakmeeds and STEM Knowledge Network partner school Hazelwick School, Crawley. Four teams of students were engaged in making and testing rocket powered cars. The aim was to see who could design and build the fastest car.

The activity was linked directly to the Bloodhound SSC Education Programme. This programme seeks to provide a catalyst through which young people will develop the skills and talents that will enable the UK to address the shortage of scientists, engineers and mathematicians.

Students were presented with only an outline for the challenge ahead of them. Applying STEM knowledge to the Bloodhound SSC project, working in teams, students applied their knowledge to achieve the best outcomes. They were given a minimum number of constraints and were required to make their own decisions regarding topics such as aerodynamics, shape, weight and look of the car. The students utilised practical technology and engineering skills, mathematics and science knowledge as it relates to aerodynamics, speed and velocity. Examples of these include fitting an accelerometer, positioning and drilling holes for axles and creating a housing slot for the engine. Data was gathered using Casio high speed video cameras, Flip video cameras, Vernier motion detectors and photogates. The data was then analysed using LoggerPro tracking software.

Reflecting on their experience, the Oakmeeds students noted how they applied skills and knowledge from all of the STEM subjects. Students:

- Felt information was far easier to remember when it was applied to something practical and meaningful.
- Stated that such learning experiences were far more likely to inspire them to study STEM. The exercises were more practical, fun, engaging and more memorable than paper based exercises and fixed controlled experiments.

- Reported enjoying the significant creative element embedded within such learning approaches, stating that they believed they had more freedom and control over their learning.
- Felt they better understand the benefits and value of working in teams, networking and knowledge sharing as part of the learning process.

Moreover, students felt that the activity had enabled them to learn not only from others but also from mistakes which they thought was crucial to their wider understanding and skills development. They also felt that the degree of uncertainty around what the outcomes might be added a greater sense of excitement and drama to the learning experience.

Students from the visiting school revealed similar reflections on the day. Whilst they felt a little apprehensive and uncertain to begin with, they enjoyed the new and exciting challenge. They noted that they had learnt new technical skills with the camera, putting it on high speed and using the slow motion function, as well as developing graphing skills that helped them plan and design their car.

New technologies were used in a variety of ways throughout the learning experience, ranging from the use of Learning Response Systems to gauge understanding and utilising Interactive Whiteboards to convey information, display data and share findings. Students also made presentations of their work, incorporating videos, as means of evaluating, consolidating and embedding learning that can be shared across the College and with wider networks.

As, Adrian Oldknow, Emeritus Professor of Mathematics and Computing Education, and visiting STEM Ambassador for the day, asserts, all schools could engage in similar activities and have the opportunity to develop 'off curriculum' days. He points out however, that many schools and teachers are afraid of cross curricula work because they fear it is difficult to deliver. Yet it does not have to happen with the whole school, or at the same time. It can start with smaller groups. If data is collected and videos are made, there are no reasons



why the learning resources can't then be cascaded and used with other students across the subject areas. Once they try such approaches, see students are engaged, more exciting and effective practices will emerge.

Pip and Professor Oldknow further argue that often teachers develop their subject knowledge in isolation, and may have limited experience of how it is applied outside of the school. However, they feel if teachers work in teams learning openly, children too will learn and risks can be taken. From this perspective, trying to encourage teachers' participation in active learning situations where they don't always know the information or outcomes but have the skills to help others find out, is essential. Because there is no direct assessment of such activities, this also means people can take risks, experiment, make learning more exciting, find out by trial and error, and learn from one another.



“If you allow students to have control over what they’re doing, engage and support them in developing and applying skills, and relate their learning to things happening in the real world, this will have a profound effect on their learning and lives. These projects can be much more easily related to the real world, common interests; issues of wider cultural, social, economic, local and environmental concerns... STEM is about working in teams, learning together, communicating the results and actually engaging with principles of science, maths and using the technology that permeates the design and engineering process throughout industry. It’s pioneering schools like this one, but it could be any school and it can spread out in waves with schools working together”.

**Professor Adrian Oldknow,
Education Fast Forward Fellow**

Certainly, professional development and new pedagogical practice is spreading throughout the College. Following one of the recent flexi-days, teachers have begun to share ideas and challenge one another to come up with new and exciting ideas and ways of teaching in their subject areas. There is a firm belief that once teachers are exposed to more exciting and meaningful pedagogical practices, they will incorporate these into their own teaching practice and challenge previous perceptions about how their subject is taught.

Colin Taylor believes that flexi-day activities, including the STEM enrichment activities, will feed into the overall development of professional practice throughout the College, and that teachers now feel more confident to try something new. There is a belief that as the attitudes and perceptions of teachers change, children will have better learning experiences. However, there is also the recognition that they have a way to go before such approaches and perspectives are embedded within a College wide culture of innovation. This is why it is important to ensure there are continued opportunities for development, risk taking and information exchange. It is important for the College that the outcomes and impacts of new approaches are clearly communicated and shared widely.



“For me it’s about engagement, it’s about learning, especially visual and meaningful learning. For example, nothing we did today was about reading. It was about talking, communication, collaboration- all the skills that are important. The children are doing it with a purpose. When they analyse the video, it’s their video, not the teachers. They take responsibility, they crop it and if they do it wrong they lose it. This way they’re in control of their learning... Projects such as these give the children freedom, the opportunity to make decisions, use their existing skills, yet they know they have time sensitive targets and deliverables. Days like this also give children aspirations. They not only learn new skills, which gives them more self esteem and confidence, they also get lots of insights into how skills, practices and knowledge are applied and they get to see positive role models”.

**Pip Huyton, Independent Mathematics
and STEM Consultant**

Teachers at the College are determined to ensure that projects and their impact remain visible so that the whole College knows there is change afoot.

One direct result of the Rocket Propelled cars day is that interest in the college STEM club has increased significantly.



This event aimed to engage teachers in providing and supporting STEM activities in a way that increases their own effectiveness and makes learning more relevant to students. It is an example of how using engaging and context-appropriate activities, education technologies and resources can effectively bring life to “hard to teach” and “hard to understand” areas of the curriculum. In this way, students are also connecting more positively with the STEM agenda and gaining more interest in STEM qualifications and potential STEM based careers.

Further Reading

RSA Opening Minds:

www.rsaopeningminds.org.uk

Bloodhound SSC:

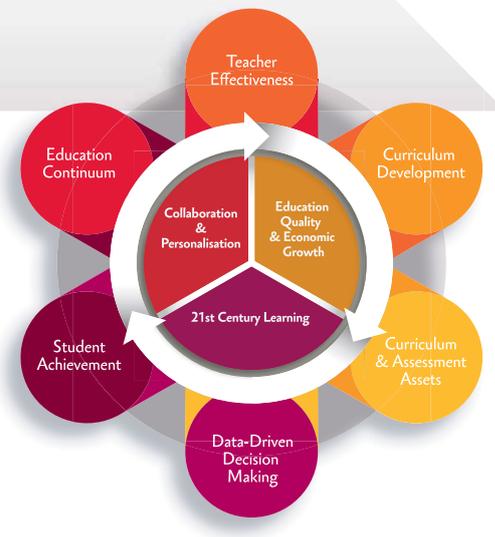
www.prometheanworld.com/bloodhound

STEMNET:

www.stemnet.org.uk

STEMNET creates opportunities to inspire young people in science, technology, engineering and mathematics and attempts to help all schools and colleges across the UK understand the range of STEM Enhancement & Enrichment opportunities available and the benefits these can bring.

“Promethean believes that education is the fuel that drives economic growth and social progress. Effective teaching is the key to successful, collaborative and personalised learning-which in turn creates better prepared students, more prosperous nations, more secure societies, and more engaged global citizens.”



Promethean’s Education Strategy Group explores and facilitates technology’s role in realising the promise of more effective educational systems locally and around the world. Through combining leading-edge research, pedagogical expertise, policy and practical insights, our approach demonstrates the impact of the long- and short-term return on investment in education technology—a theme central to the realities of 21st Century Learning.

The group focuses its efforts around six Educational Themes that are key to achieving global education success:

The Themes That Matter

Teacher Effectiveness— examines how technology can help teachers in every aspect of their work.

Curriculum Development— surveys the way the face of learning is changing, especially in critical areas such as science, technology and mathematics.

Curriculum & Assessment Assets— considers how technology can enable shifting curricula to be linked with learning assessment;

Data Driven Decision Making— pursues insights into how educators can use data to improve individual and system-wide performance.

Student Achievement— studies how technology best facilitates personalisation and collaboration in teacher/student and student/student interactions.

Education Continuum— explores how technology supports learning system success throughout schooling and into the workplace.