

Premier’s English Teacher Association English Scholarship

The Continuing Value of English in a STEM World

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# Introduction

The Federal Government has identified that Australia’s future lies in the “Ideas Boom” and the “need to embrace new ideas in innovation and science.” The funding boost to embed Science, Technology, Engineering and Mathematics (STEM) into Australian schools mirrors the rise of STEM across the education world (Office of the Chief Scientist, 2013). Important questions are raised by the growing focus on STEM in schools in terms of parity with whole school curriculum:

* Where does the emphasis on STEM leave the study of English, particularly the study of literature?

How can English maintain its key role in the academic, verbal, written, and social development of students in a STEM world?One of the key fears for non-STEM teachers, particularly English teachers, is that this new paradigm will signify a loss of importance for their own subject. There is growing concern about the dumbing down or diluting of our subject, a fear of English becoming subsidiary to the STEM directive, and that was certainly the premise behind my scholarship: to discover the continuing value of English in a STEM World.

# Focus of Study

The study tour took me to the heartland of the STEM push in the United States of America (USA). STEM schools including Stuyvesant High School and Bronx High School of Science in New York, High Tech High in San Diego and The STEM Academy in Georgia are identified in the nation’s top performing schools. A priority of the study tour was to understand where the subject of English is placed in this new education paradigm. To this end, I shadowed and interviewed educators in leading USA STEM schools in New York, San Diego and Savannah, including the ones mentioned above, to examine how English is impacted as a stand alone subject and integrated in transdisciplinary units of work. I also attendedtwo major education conferences, these were: ITEEA Conference2018 - Building Bridges Within the STEM Community and Beyond Education and the Deeper Learning Conference 2018 hosted by High Tech High to gain a better understanding of how and why schools are incorporating STEM and STEAM (Science, Technology, Arts and Mathematics) into their curriculum. Finally, I met and interviewed two educators who have pioneered and championed STEM and STEAM in US schools to explore how they see English fitting into this educational approach, and whether attitudes and approaches have changed since STEM was first introduced in schools.

# Significant Learning

### The schools I visited during my study tour approached the teaching of STEM in a multitude of ways. Their approach was dependent on many factors: the school’s ethos, curriculum, structure and even the facilities available to them. The way they approached STEM greatly influenced the way English was taught, whether they incorporated English into the design projects and, as a result, impacted the ways in which English was valued.

## Level One: The value of English in STEM subjects

STEM is often introduced into schools as projects which focus on developing and applying knowledge of the sciences, engineering and/or mathematics. These are usually planned and taught by STEM teachers. Using the scientitic or design process method, students will be challenged to test their knowledge, solve an issue or create a product and then present their findings in some way, ideally to an audience that includes people from the community.

In these types of STEM projects, English often has no formal involvement in the process of the project itself. And really, why should it? After all, English is rarely involved in the learning process of other subjects within more traditional, siloed, curriculum structures. After all, in the learning process of other subjects within more traditional, siloed, curriculum structures, subject English is rarely involved.

 However, the skills introduced and then honed in English are vital to the success of every project. By the very nature of the subject, English supports students to build the many skills needed to successfully complete the project including :

* comprehension skills to unpack the often complex and dense texts students will read in the development of their project
* the ability to compose a range of texts in order to organise their thoughts and convey their ideas
* the speaking and listening skills necessary to work effectively as a group to achieve their goals
* the visual and digital literacies vital to the successful presentation of their “product”.

Further, many of the projects involve marketing and advertising elements in the “selling” of their ideas which are a natural extension of their study of persuasive texts and techniques in English.

The link between STEM and literacy was effectively highlighted in my visit with Lynn Cole at the Discovery Center at the Queens Children’s Library. Lynn and the librarians, from their pre-school play groups to their high school maker programs, consistently linked science knowledge with literacy development and vice versa through the building of vocabulary and ~~the~~ reading skills.

Interestingly, when I asked STEM students at Stuyvesant High School and the Bronx High School of Science, what they saw the value English was, it was these skills that they highlighted. They recognised the important role their English lessons play in the development of the literacy skills needed to succeed in their STEM courses.

## Level Two: The value of English in STEM schools that do not have an integrated curriculum

Some STEM schools, such as Stuyvesant High School and the Bronx High School of Science, have a strong focus on STEM, but within a more traditional structure which incorporated opportunities for Design Based Learning (DBL) projects and STEM challenges. It is expected that English teachers, as well as those in other faculties, support the STEM push where possible through their choice of units and approach to teaching. In my school visits, I observed that:

1. English teachers in these schools have incorporated significantly more non-fiction into their units of work than we would do in NSW schools. This is in order to support students’ competency in both analysing and composing the types of texts they would be accessing in STEM subjects, particularly in the research and design phases of their projects. Teachers have added in assignments that ask students to write in forms other than narrative and literary responses, such as research reports and journal articles. The introduction of more information texts into the English curriculum help to develop students’ comprehension skills, the sophistication of their vocabulary and writing structures as well as extending their writing skills beyond those typically focused on in more traditional English classrooms.

In the Grade 9 class I observed at Bronx High School of Science, for example, they were all reading texts that had a teenager as a protagonist. Their culminating task was to write a three page research report, synthesising ideas from articles and websites which focused on teenage psychology and their novel and writing their report from the perspective of an adolescent psychologist. This unit, and its culminating task, not only allowed the students to go deep into their novel and its values, but also ensured that students had an opportunity to develop this textual form which would also be used in their STEM subjects, such as Science.

This increased focus on informative and even discursive reading and writing is powerful for both English and STEM outcomes. In fact, the new NSW Stage 6 English Syllabuses have identified these two text forms as being of equal importance to imaginative and persuasive forms.

1. Critical thinking is a key skill in STEM and the scientific method. The design process also asks students to identify an issue, form a hypothesis, test it and then refine their thinking as a result of their findings. They also need to communicate and defend their position. Critical thinking is also important in English and, in all the schools visited, English teachers incorporated opportunities for students to think critically about what they were studying and to effectively test and communicate their thinking.

The English lessons I observed, from pre-schoolers at Blue School to Advanced Placement (AP) students at Stuyvesant HS, were very student focused and driven - students were expected to share their understanding of the text or topic, to respond to and extend on the comments of their classmates and to pose questions for further exploration. The teacher often acted as moderator, pausing discussion to add clarification or to expand on points, as well as posing further questions. All discussion was consistently linked back to evidence such as the text itself. This focus on the students developing, testing and validating their opinions is explicitly tied to the scientific method and design process.

As well, the development and assessment of critical thinking was evident in the use of driving questions introduced at the start of each lesson and in the focus of many of their assessment tasks. For example, at Stuyvesant High School, Eric Grossman sets ‘The So What? Task’. In this task, students are to explore the value of reading two or three of the texts they have studied. What resonated with them, what moved and/or challenged them? In other words, why should we read not only these particular texts but literature in general? This approach to assessing their study of literature supports the wider school’s focus on critical thinking and analysis through the thoughtful defence of their chosen perspective, whilst still being a powerful summative assessment of their English unit.

1. Research skills, including how to compose research reports, were explicitly taught across all school sites as they were seen as a vital component of STEM. Bronx High School for Science, Blue School and The STEM Academy, have in fact developed research based courses for their students, often developed by both science and English staff. In all schools, opportunities for research and the sharing of their findings were central to the teaching and learning cycle in English.

Students are taught how to develop an informed opinion through research. Bronx High School of Science, for example, challenged students as part of the research process in all subjects to: choose their topic and find an authoritative paper supporting their point of view, pose a counter argument and find a paper/evidence that supports that it and finally, defend their point of view in light of that evidence. Naturally the notion of an authorative paper would differ depending on the subject and topic but the process was basically the same.

All students were taught scaffolds for presenting and supporting their findings. A common feature of all scaffolds was the making of a claim and then supporting that claim with relevant evidence. At the Bronx Middle School for Young Leaders, Alex Corbitt used the CREW scaffold where CREW stands for Claim, Reason, Evidence and Warrant (effect). At Bronx High School of Science they used ICE – Introduce the citation, Cite the evidence and then Explain the evidence. While the chosen scaffold varied, the focus in all of them was on documenting their claims with supporting evidence. Further, the scaffold was used across subjects and faculties to ensure a consistent structure and approach.

Therefore, at this level of STEM, English has significant value to ensure that the students have the skills and confidence to excel in their STEM endeavours. Building on the more essential literacy skills valued at the introductory level, the English syllabus includes many opportunities for students to learn and practice the high order skills needed to not only master English but STEM as well. As a result, the value of English is heightened, not weakened.

## Level Three: The value of English in STEM/STEAM schools with an integrated, multi-discipline curriculum

The ideal approach to gain the maximum educational benefits of the STEM approach is to incorporate the arts, including English and the umanities, as equal partners in the learning. Thus, STEM becomes STEAM. STEAM projects need to start in the arts, particularly the social sciences, as they supply the why and who to the what and how of STEM.

Georgette Yackman, who introduced the term STEAM as a graduate student and who now supports schools worldwide to embed STEAM practices into the curriculum, identifies that the best projects are reality based. In other words, projects that are linked to real situations, community needs, and useful beyond the classroom. This is why she advocates starting with the social sciences (arts) rather than in the sciences. Tapping into local issues, student concerns and interests, this will broaden their world view through exploring others’ experiences and situations, allowing teachers wide scope for open ended projects. Thus providing the real world element needed to add purpose to the projects.

In this model, English (or Language Arts as it is called in the States) can actually stimulate and initiate STEAM projects, not just build the skills needed for developing and presenting their work via explorations of advertising and marketing, visual literacy, persuasive and reflective writing . Their study of texts, extended on through their projects, can powerfully raise students’ knowledge, skills and empathy.

Schools who are embracing a more integrated approach to the curriculum, such as The STEM Academy in Savannah, have teachers from across subjects plan the projects in order for all subjects to have an equal role in the delivery of learning and the meeting of identified standards. Grade 6 students read novels that focused on the plight of communities, across the centuries and across the globe, such as ‘A Long Walk to Water’ and ‘While the World Watched’ to introduce their grade’s ‘Grand Challenge’. Their challenge focused on students developing solutions to the access of clean water as well as raising awareness of the issue. The study of these texts added important contextual information as well as giving the project a human face. Their connection to the characters in the texts allowed students to build empathy and ensured a greater sense of purpose to the completion of their Grand Challenge. Later in the development cycle of the challenge, English teachers would also teach students how to market and promote their culminating products as well as present them effectively via Shark Tank style pitches and advertising campaigns.

English faculties, libraries and STEM organisations have also started to develop literature databases for texts (novels, biographies, picture books and films) that can be used in STEM or STEAM projects – as the catalyst for the project, to add another layer of content and context, and to challenge the ethics behind the science. The inclusion of literature to the planning and execution of STEM has grown in recent years and shows that all involved in STEM education see the valuable role English plays in the pursuit of building engaging and intellectually challenging learning opportunities.

# Conclusion

From the school visited, conferences attended and educators interviewed on my study tour, I must happily conclude that English continues to maintain its place as one of the core subjects for all school systems regardless of whether they are just incorporating STEM projects within the STEM subjects or they are running a fully integrated curriculum.

A common thread from English teachers in regard to the growing STEM focus, was the fear that their subject would be reduced to teaching functional literacy skills. Certainly, literacy skills played a key role at all levels of STEM education initiatives and reading, writing, speaking and listening are core to our subject. Our key role in producing articulate and confident communicators is something we should embrace and be proud of. They are the essential skills needed for academic success and for life beyond school. STEM teachers and students acknowledged this, and perhaps this is a key message for education in Australia?

Additional to this, however, is the important role English plays in developing intellectual rigour and the critical and creative thinking skills needed for the deep learning which is the aim of STEM and STEAM projects through the exploration of literature and more real world informational texts. English teachers in the schools I visited, have actually extended and diversified what they teach and how they teach it, due to their support of the STEM focus which drives their schools. As a result, English classrooms and English students have benefited from the STEM drivers in their school as much as they have benefited from subject English.

As a profession, English teachers can ensure that the subject’s key role continues in a STEM world by embracing the power of the STEM approach to learning within their own classrooms. The new educational paradigm behind the STEM push – design based projects that focus on the development of the essential soft skills – has the potential to re-invigorate English as a core subject and build on its already considerable value. Working together, we are more than the sum of our parts.

This is now my challenge; bringing the considerable benefits of the design process cycle to mine and others’ classrooms to build on English’s pivotal role in the curriculum. I have already shared what I have learnt from each visit via my scholarship blog and through social media, therefore the discussions and sharing have already commenced. I will continue to disseminate the resources and ideas through the ETA’s journal, mETAphor, and through workshops including the annual ETA conference. Closer to home, I will work with my English faculty to start embedding some of the teaching approaches I observed and add DBL opportunities to our units of work. As well, I will work with the school’s executive to see how we can, at a minimum, add an integrated “Grand Challenge” to each year group.

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