Content and Process, A Balance for Success in Problem-Solving
Harry T. Roman   Engineering Technology Educator and Inventor

Introduction
In the final analysis, it is about balancing content and process and doing something useful with it, like solving an urgent problem facing society. Stuffing young minds with just content or advanced content for that matter is meaningless. It is like having the content equivalent of a high performance automobile. Without process (the steering wheel) there is little chance of delivering all that content to a worthwhile destination. This I fear is the greatest challenge facing all schools today, the ability to fashion steering wheels.

I shall use another analogy. We are all vectors, possessing magnitude (content), and hopefully direction (process). The coin of the realm in the business world is being able to solve problems, complex problems, and to do so from a multi-dimensional and multi-disciplinary perspective – and usually in a project team format. If given a choice between incoming graduates, the business world on average will likely hire the ones who are more process competent. The steering wheel, to use the analogy immediately above, makes all the difference. Horsepower can always be increased later, but someone with not-so-good process skills will not last long in the professional world.

Similar to the mantra of the educational world to integrate the curricula, business sees the need to integrate its decision-making, using a blended approach between the technical and non-technical aspects of a solution. Multi-faceted problem solving is the crème-de-la-crème of the business environment. This, executives reason is a "process directed thing."

There is also an emphasis on the rapid development of new knowledge, the integration and synthesis of raw data and information into strategic knowledge that can be used to achieve competitive advantage. Sociologists often refer to this time as the Information Revolution, but it may be more accurately described as the Knowledge Revolution, for it is a time of global inter-relatedness and intense international business competition, the success of which is governed by the ability to apply know-how (process + content) to problems and achieve economic solutions before the other guy.

The Educational Gestalt
It would seem then, for students to be prepared for this highly competitive world, they should be adept at applying both process and content skills, and be educated within an environment of intense problem solving activities. Given the discussion above, ideally this would be conducted using open-ended problem solving challenges where student and/or student teams would approach the problems by first fashioning the problem statement themselves. Take guidance from one of this country's all–time problem solvers: **"Tell me and I forget. Teach me and I remember. Involve me and I learn."** - B. Franklin

It stands to reason we should be teaching gifted and talented students how to ask high quality questions. They should get to know problems, communicate with them, and extract information they can use and build upon. It also stands to reason that since problem solving is so dependent upon viewpoints, outlooks, and question asking, it is a messy and somewhat unstructured, endeavor. Gifted students need to be comfortable solving problems in this environment, empowered to reach outside the box if need be, without fear of academic penalty. This is exactly why we hear such terms in the educational lexicon as: - Teaching across the curricula   - Integrated thinking - Subject integration - STEM (science, technology, engineering, mathematics) - Technological literacy - School-to-work - Lifelong Learning.

Lurk at the Interfaces
Civilization is a tapestry, woven with some thick fundamental threads like: - Society - Economy - Technology - Environment - Government - Law - Politics - Global perspective.

When we solve problems we should be trying to include consideration of these fundamental threads in both the question asking and solution formation. For instance, when trying to implement a new cross-cutting technology like nano-particles, it will most definitely have impacts on the fundamental threads, and hard questions need to be asked at the outset to help define a high quality solution down the road. Our problems today with the automobile and our dependence upon oil stem from our inability to get high quality solutions many years ago when the automobile was young, and question asking was in its simplistic infancy. There are penalties to be paid down the road (no pun intended) with simplistic solutions that lack multi-dimensionality and multi-disciplinary approaches.

The really rich soil for intellectual exploitation exists at the interfaces between subjects and the threads of civilization. Where these threads meet, new research ideas are forged, lush new subject matter grows, and new knowledge is born. These are where the tectonic plates of knowledge build new continents, and tear down the old. When gifted students solve problems, these interfaces are prime areas for their creative thought, and out-of-the-box paradigm shifts. Teach them how to lurk at these points and be comfortable with exploring how technical and social issues interact. Empower them to explore and create!

Check Out Technology Education!

A superb educational paradigm that balances content and process is technology education. I was there at the beginning of its inception in the 1980s, and today 25 years later, it is a national phenomenon. It is a powerful testimony to motivating students to see the relationship between technology and the rest of the tapestry of civilization. In short, technology education is the study of the human designed world, with plenty of opportunity for head and hands problem solving and integrated, context-based design challenges. In this environment, the process component is focused on problem solving and the content is every other academic subject woven and blended into the solution.

Technology is the very foundation of our economy, accounting for about 60% of the growth in our annual economy. It is all around us from computers and cell phones to iPods and iPads. Its visibility makes its use in the classroom as a learning paradigm instantly recognizable, and wonderfully relevant. Introduce your gifted students to the world of technology, and the joy of real-world problem solving.

A very recent trend in technology education is to very seriously own the "E" in STEM…"Engineering"…and bring its naturally multi-disciplinary/multi-dimensional perspective into the classroom. Because engineering is a composite profession, its process and content reaches across the entire spectrum of society from science, technology and math to history, social studies, economics, environment, law, and the humanities. The human designed world of the engineer affects the entire tapestry of civilization. Technology education teachers challenge their students to work with both heads and hands and address the many constraints that daily confront the work-a-day world of engineers.

Getting Down to Brass Tacks

Let's put this discussion into perspective with some integrated thinking activities you might try in your classroom:

1.) Solve a complex problem from a single perspective first and then add new perspectives. For instance, solve a problem from first a technical perspective only and examine the result. Then add a second perspective like economics and re-examine the result. Later add an environmental perspective and re-solve and re-examine once more. Continue to add new design constraints and discuss how each new constraint acts to re-shape the solution and add texture and richness to the final result.

2.) Engage your class in a detailed evaluation of how the world's greatest inventor, Thomas Edison. combined his vast technical and scientific knowledge and his methods of research into what has often been described as his greatest invention….his invention factory in his West Orange Labs in West Orange, NJ. Here Edison formulated and put into practice the concept of an R&D lab which showed how to take a new idea from bench-level prototype to a commercial product. He employed scientists, engineers, technologists, mathematicians, and marketers (content knowledge) and motivated this through his project management staff and himself (process knowledge) to bring many new products to the consuming public.

3.) Have your gifted students keep a journal or diary of their ideas and concepts so as to discover how they use a personal process to solve problems. In this journal, students can discuss how they perceive a problem, make inquiries of it, and then create/invent some potential solutions. The problem you may challenge them with could be quite practical, perhaps: - Design a better way to carry books to school. - Design a first-aid kit for the family car; or - Design an educational card game to teach multiplication. In the journal, each student can record their thoughts and ideas and produce descriptions, sketches, diagrams expressing them; and over time, come to refine their initial ideas into potential new products. Here you can show the analogy of this journal to a scientist's lab book or an inventor's notebook. After the students complete their work, they can compare each other's journals to identify similarities and differences in order to learn from each other.

4.) In the business world, the multi-disciplinary aspects of problem solving are represented by a diverse project team usually being assembled to solve pressing problems. The concerns and values assigned to certain aspects of the problems being solved are often visualized in a spreadsheet style format. If possible, invite professionals in from the business community to discuss how problems are solved and how a corporation goes about determining which new products are going to be developed and why.

5.) Bring the history of the country and the world into play as well, for this perspective teaches us how humans have shaped their world over time. This directly influences how questions are asked and visions for the future are conceived. Look at the global warming argument – examine it as a proposal to not only switch to different fuel forms, but as a different way of living, a virtual change in the living process, driven by a changed set of knowledge about our planet and its evolution. Here content can drive process.

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