Course Overview
Design & Construction at Tom Baines

What is Design & Construction? (FOR Parents/Guardians)

(STUDENTS: You may want to skip this section as it I have written it mostly for your parents.)

Design & Construction (D&C for short) is an evolution of what some may know of as "Shop Class" or "Industrial Arts" to a "Maker Space". While many of the activities that are possible in a traditional shop class are still available (such as Woodworking and Metalworking), the overall purpose and scope of possibilities has changed dramatically.

The rationale for changing the program is a reflection of a number of changes in the world of work and technology including:

- Rapid technology changes that are and will continue to make significant changes in what types of jobs are possible (such as the prospect of automation affecting many areas of work).
- The decreasing cost of technology (hardware, including digital fabrication tools such as 3D printers) and the proliferation of open source (freely available) software that puts remarkably complex tools in the hands of anyone - not just engineering specialists.
- Recognition that to be successful in many careers students will need to be "as unlike a robot as possible" since automation will affect many areas of work. The types of uniquely human skills that will always be in demand include:
    - Ability to work collaboratively with others.
    - Being able to create and be creative!
    - Critical thinking and problem solving in the face of very open-ended problems.
- It is increasingly being recognized that a "skills based" approach (learning specific skills) is not as powerful as a "fluency or literacy" (such as Invention Literacy) based approach. For years I was a manager at a software company based in Silicon Valley in charge of hiring. While competency in specific skills is always valuable, I knew that the relevant skills of today would soon become obsolete and so as an employer was mostly focused on those who demonstrated an ability to learn, problem solve, collaborate, and communicate.
- While many of these technology changes present challenges, they also present huge possibilities. Students are often very engaged when given access to these powerful technologies and the ability to *apply their own ideas to create*. Hands-on experiential learning can be a powerful, generative, and empowering experience.

In response to these changes, the D&C classroom is designed to learn key understandings and attitudes through hands-on skill development based on their own interests. The following sections describes these key understandings and related skills.

What will students learn in Design & Construction?

The Design & Construction program is all about 'learning while doing'. The **key understandings and attitudes** students will explore and develop are:

- **Invention Literacy.** The ability to create human made 'stuff'. The ability to create in the 21st century is made more powerful with knowledge of:
    - **Coding (computational literacy)**. Students will have opportunities to learn and demonstrate their understanding of the foundations of coding and apply them in various contexts which may include interactive games, apps, robotics, and digital electronics (microcontrollers and microcomputers).
    - **Design Thinking**. Students will learn this powerful way of approaching design and creating that is used in many contexts for *finding* and *solving* open-ended problems.
    - **Mechanical Tools**. Students will have opportunities to learn how use a wide variety of tools and skills as appropriate to the 'stuff' they want to create. This includes many of the traditional shop tools such as Band Saws and Scroll Saws and much more.
- **Empowered Creators, not just Passive Consumers.** Students will hopefully develop confidence in facing open-ended problems where **personal initiative**, **collaboration**, and **communication** will be required. They will feel empowered not just to consume technology, but find new ways to express themselves. An important part of the creative process is facing the inevitable frustrations and difficulties in creating something new and learning **how to handle unexpected problems**.
- **Career Possibilities**. With an eye on the future, students will make connections with their current interests and skills and possible career options in a rapidly changing world.

"People overestimate what can be accomplished in the short term, and underestimate the change that can occur in the longer term." - Futurist and entrepreneur Ray Kurzweil talking about technological change.

The *key understandings and attitudes* just described apply to all grades taking D&C. However, another important element of the D&C program is giving students a great deal of choice in what projects they take on and therefore what specific skills they may develop. The amount of student choice increases with grade level so that grade 9 students will have the most amount of time available for their own projects.

Topics and Skill Development in Design & Construction

The following table describes various topics and specific skills and related equipment that students MAY encounter in the D&C room depending on student choice and grade level. Note also that one project may involve multiple topic areas.

Topic	Example Skills	Related Machines/Equipment
Design	Design Thinking Invention Literacy 3D Design	Cardboard (Important tool in the D&C room for rapid prototyping design ideas!) Wood Metal 3D Printing …
Woodworking	Materials (Types of Wood) Safe and appropriate use of Tools Designing with Wood (measurements, cost estimates) Joinery Finishing (Sanding, Painting and Staining)	Hand Tools *(Saws, Clamps, Planes, Marking Tools, Drivers, Chisels, Hammers…)* Power Hand Tools *(Sanders, Jigsaw, Biscuit Joiner, Dremel, Wood burners, Cordless Drill…)* Power Tools *(Drill Press, Belt and Disc Sander, Scroll Saw, Band Saw, Oscillating Spindle Sander, CNC Router, Table Router, Wood Lathe, Jointer, Planer…)*
Robotics	Input Devices (Sensors) Output Devices (Motors, LIght, Sound,…) Coding	Lego Mindstorms EV3, microcontroller (Arduino) based robotics.
Coding/ Programming	Coding Foundations including: ● Sequence of commands ● Loops ● Conditional Statements ● Variables ● Event Driven Programming ● Functions	Scratch Lego Mindstorms EV3 Software Arduino Mobile App Development Tools Raspbian …
3D Design	2D vs 3D Design Presenting Designs (Isometric and Orthographic projections) Materials and Design (How Design impacts Material Choice and Material Choice impacts Design).	Pencil & Paper Drafting Tools Computer Aided Design (CAD) Software 3D Printers CNC Router Cardboard/Wood/Metal
Electronics	Electrical Circuits Digital Electronics Soldering	Components: LEDs, Buttons and Switches, Resistors, Capacitors, ICs,.. Raspberry Pi Arduino Little Bits
Metal Working	Cutting (Shearing) Bending (Rolling and Folding) Finishing Fastening (Rivets, Tap and Die)	Snips, Ball Peen Hammer Box and Pan Brake Guillotine Bending Rollers Bending Machine…
Other Possibilities	Jewellery Making (Copper Pendants, Bracelets..) Stained Glass	Copper Glass …

	Silk Screening Electronic Clothing	

Classroom Expectations

Because of the nature of the D&C program, at times students (individually or in small groups) may be working on very different things at the same time. This can result in an extremely busy classroom environment and as such **Safety** and **Respect** are paramount. Classroom procedures around the use of equipment are made clear and must be followed. These procedures include:

- Safety apparel (safety goggles and aprons) must be worn when using equipment of any kind.
- No equipment may be used without checking with Mr. Hogg (EACH time).
- Students must be *certified* as trained on the safe and proper use of a piece of equipment before using it (how to certify is explained in class).
- Students are expected to be helpful! Keeping the classroom functional means it is everyone's job to tidy and clean EACH class.

I have had students tell me that they felt my class was safer than other "shop classes" they have been in even though students have a great deal of autonomy and personal choice. This is only possible if students take personal responsibility for themselves, their classmates, and the equipment seriously. Any horseplay or inappropriate use of tools *will not be tolerated* and students will quickly find they will not be able to fully participate if they do. The vast majority of students at Tom Baines engage in a safe, respectful, and helpful manner which is what makes the entire program possible.

Assessment and Communication

Students are assessed according to the general outcomes of the Career and Technology Foundations (CTF) curriculum as mandated by Alberta Learning. You can find out more at my class website (teacherhogg.info/parents). The main learning outcomes mandated are:

- CTF is exploring interests, passions and skills while making personal connections to career possibilities.
- CTF is planning, creating, appraising and communicating in response to challenges.
- CTF is working independently and with others while exploring careers and technology.

One of my goals as a teacher is to encourage students to take responsibility for their own learning. As such, my main form of communication in regards to assessment is directed to students. Students will receive emails (to their @educbe account) from me with marks and comments on their work. These emails are also intended to serve as a portfolio of their work (in some cases including photos of their work).

I encourage parents to ask students to share the contents of these emails with them. As a parent of 3 children, I realize that in some cases you may want additional and direct feedback. Feel free to contact me directly with questions or concerns. The simplest way to communicate is using my parent email (dwhogg@cbe.ab.ca). Of course, report cards are also used to communicate assessment.

Contact

David Hogg

Class Website: teacherhogg.info
Parent Email: dwhogg@cbe.ab.ca (parents use this only please)
Student Email: dwhogg@educbe.ca (students use this and only from their educbe account)

Note that the class website (teacherhogg.info) is also used a great deal to communicate and provide information to students.