
Drafting and Computer-Aided Design 10, 20, 30 Curriculum Guide

A Practical and Applied Art

Saskatchewan Education
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Introduction

Within Core Curriculum, the Practical and Applied Arts (PAA) is a major area of study that incorporates five traditional areas of Home Economics Education, Business Education, Work Experience Education, Computer Education, and Industrial Arts Education. Saskatchewan Education, its educational partners, and other stakeholders have collaborated to complete the PAA curriculum renewal. Some PAA curriculum guides have been updated; some components have been integrated, adapted, or deleted; some Locally Developed Courses have been elevated to provincial status; and some new guides have been developed.

A companion *Practical and Applied Arts Handbook* (Draft 2000) provides background on Core Curriculum philosophy, perspectives, and initiatives. The Handbook articulates a renewed set of goals for PAA. It presents additional information about the PAA area of study, including guides about work study and related Transition-to-Work dimensions. In addition, a PAA Information Bulletin provides direction for administrators and others regarding the implementation of PAA courses. Lists of recommended resources for all guides will be compiled into a PAA Bibliography with periodic updates.

Philosophy and Rationale

Technical drawings are essential to constructing everything in society from the house one lives in to the computer on a desk. These drawings, created by a draftsman, must be understood by hundreds of other people in our society. The renewed Drafting curriculum is designed to promote understanding and application of the graphical language used in technical drawings. Drafting will provide a foundation for future employment or post-secondary education in many fields.

Aim, Goals and Foundational Objectives

Aim

To provide students with opportunities to acquire knowledge and develop skills in drafting.

It is highly recommended that students have the opportunity to develop skills with Computer Assisted Drawing (CAD) software. Manual drafting can be used to develop similar skills where CAD hardware and software are currently not available.

Goals

Awareness: To develop an appreciation for drafting and the numerous trades where it can be used.

Technological Advances: To obtain a working knowledge in the fundamental principles of CAD and/or manual drafting.

Communication: To communicate effectively in a non-traditional classroom environment.

Independent Learning: To develop independent work practices.

Accountability: To instill a sense of pride and responsibility for one's work.

Career Development: To make informed career decisions based on experiences.

Foundational Objectives

Foundational objectives are the major, general statements that guide what each student is expected to achieve for the modules of the PAA curriculum guides. Foundational objectives indicate the most important knowledge, skills, attitudes/values, and abilities for a student to learn in a subject. Both the Foundational Objectives for *Drafting and Computer-Aided Design* and the Common Essential Learnings (CELs) Foundational Objectives to be emphasized are stated in this document. Some of these statements may be repeated or enhanced in different modules for emphasis. The Foundational Objectives of the Core Modules of the Drafting and Computer-Aided Design curriculum include:

- to understand the use of the different tools used in drafting.
- to learn the basic functions of Computer-Aided Drafting (CAD) software.
- to use the basic manual tools traditionally used in production drawings.
- to maintain a high standard of quality for drawings produced.
- to appreciate the concept of scale and proportion.
- to manually sketch drawings of manufactured forms.
- to be able to use and understand the terminology related to drafting.
- to understand the representation of three-dimensional objects presented on a two-dimensional plane.
- to be able to describe size on a multi-view drawing.
- to be able to describe shape in a multi-view drawing.
- to be able to produce drawings for architectural projects.
- to understand the use and location of materials used in the construction of a typical house.
- to be able to produce simple working drawings for mechanical projects.
- to become aware of the career opportunities that exist in the field of drafting.
- to create drawings of basic objects in a three dimensional (3D) environment.

Common Essential Learnings (CELs)

The incorporation of the Common Essential Learnings (CELs) into the instruction and assessment of the Practical and Applied Arts (PAA) curriculum offers many opportunities to develop students knowledge, skills, and abilities. The purpose of the CELs is to assist students with learning concepts, skills, and attitudes necessary to make transitions to career, work, and adult life.

The CELs establish a link between the Transition-to-Work dimensions and Practical and Applied Arts curriculum content. The Transition-to-Work dimensions included in the PAA curricula are: apprenticeship, career exploration/development, community project(s), employability skills, entrepreneurial skills, occupational skilling, personal accountability, processing of information, teamwork, and work study/experience. Throughout the PAA curricula, the CELs objectives are stated explicitly at the beginning of each module and are coded in this document, as follows:

Common Essential Learnings (CELs) Coding

COM	=	Communication
NUM	=	Numeracy
CCT	=	Critical and Creative Thinking
TL	=	Technological Literacy
PSVS	=	Personal and Social Values and Skills
IL	=	Independent Learning

Although certain CELs are to be emphasized in each module, as indicated by the CELs Foundational Objectives, other interrelated CELs may be addressed at the teacher's discretion.

Course Components and Considerations

The new *Drafting and Computer-Aided Design* curriculum is intended for schools that use computer-assisted drafting and schools that are in transition from manual drafting. It should be recognized that manual drafting is rarely a skill employers are looking for in today's job market and that all efforts should be made to modernize equipment and practices in the classroom. The Introductory level modules are developed for students who have no previous drafting experience. The intermediate and advanced modules build on competencies developed at the introductory level and introduce architectural and mechanical drawing fundamentals. Students are encouraged to maintain a portfolio of their work throughout the courses. The portfolio may be electronic or hard-copy. As students develop skill, they may wish to cull the portfolio so that it represents their best work.

There are several good Computer-Aided Drafting and Computer-Aided Design packages on the market. Some terms used in this curriculum guide are software specific.

Work Study Component

Work Study provides students with an opportunity to enhance personal skills and to develop skills using industry equipment and standards not available in a school setting. Refer to the Work Study Guidelines, a section of the *Practical and Applied Arts Handbook* and to the *Work Experience Education Guide* (1989), for information on required and best practices for student preparation, employer partnerships, and teacher responsibilities.

Note: the *Work Experience Education Guidelines* are being renewed as the *Career and Work Exploration Curriculum Guide*.

Portfolios

A portfolio is a valuable organizer of student projects and assignments. Envelopes, files, binders, or folders serve to compile information over a term for a student. Each student should have a portfolio representing his or her work during the course. Students may construct portfolios in which to keep their work and assessments throughout the term. Two portfolios may be valuable: a "working portfolio" to collect ideas observations, notes and critiques, and a "presentation portfolio" to maintain completed work. By keeping track of this material, students are able to monitor their level of achievement. Additions to and revisions of the portfolio should be done at the end of each module.

The development of a portfolio is an important communication tool because it provides information for students, teachers, post-secondary institutions, community organizations and potential employers.

The portfolio can help the student:

- reflect on personal growth and accomplishment
- see links between home, school and community education and activities
- collect materials to prepare applications for post-secondary education scholarship and program entrance
- collect materials to prepare for employment applications
- focus on career planning.

The portfolio can help the teacher:

- provide a framework for independent learning strategies for the student
- communicate student learning from one school year to another in a specific area of study
- identify career planning needs for students
- assess and evaluate the student's progress and achievement in a course of study.

The portfolio can help post-secondary institutions:

- determine suitable candidates for awards and scholarships
- evaluate candidates for program entrance
- evaluate prior learning for program placement.

The portfolio can help the community:

- reflect on the involvement in a student's education
- demonstrate the link between the home, school, and community in education.

The portfolio can help potential employers:

- identify employable skills desired in future employees
- provide evidence of knowledge and skill development of potential employees.

Through reflecting, updating and culling, students are able to compile portfolios that display only their best and most recent collection of work.

When a teacher examines a student's portfolio in order to make a decision regarding student progress, the information it contains may become documented evidence for the evaluation.

A daily journal may also become a part of a working portfolio as a means of tracking the student's use of time and to record progress on ideas that are being developed. This will provide the student with a focus for self-directed or independent learning as well as an anecdotal record for part of the course evaluation.

Resources

To support the principle of Resource-based Learning a variety of instructional resources have been evaluated and recommended to support the teaching and learning of *Drafting and Computer-Aided Design 10, 20, 30*. See *Drafting and Computer-Aided Design 10, 20, 30: An Initial List of Implementation Materials* for recommended resources that will eventually be compiled into a PAA bibliography.

Teachers should also check the department's Learning Resources Distribution Centre (LRDC) catalogue. An on-line ordering service is available.

The on-line version of this Guide is accessible at www.sasked.gov.sk.ca/docs/paa.html. It will be "Evergreened", as appropriate.

Assessment and Evaluation

Student assessment and evaluation is an important part of teaching as it allows the teacher to plan and adapt instruction to meet the specific needs of each student. It also allows the teacher to discuss the current successes and challenges with students and report progress to the parent or guardian. It is important that teachers use a variety of assessment and evaluation strategies to evaluate student progress. Additional information on evaluation of student achievement can be found in the Saskatchewan Education documents entitled *Student Evaluation: A Teacher Handbook* (1991) and *Curriculum Evaluation in Saskatchewan* (1991).

It is important that the teacher discuss with students the evaluation strategies to be used in the course, when the evaluation can be expected to occur, the weighting of each evaluation strategy, and how it relates to the overall student evaluation. The weighting of the evaluation should be determined in relation to the amount of time spent and emphasis placed on each area of the course, as suggested in these curriculum guides. A suggested evaluation for Drafting and Computer-Aided Design is as follows:

Here is a sample evaluation scheme.

Tests (written)	25%
Project work	15%
Portfolio	15%
Homework and Assignments	10%
Classroom Presentations	10%
Work Study	25%

As discussed in the *Practical and Applied Arts Handbook* (Draft 2000), there are three main types of student evaluation: diagnostic, formative, and summative.

Diagnostic evaluation usually occurs at the beginning of the school year or before a unit of instruction to identify prior knowledge, interests or skills of students about the subject area.

Formative evaluation is an ongoing classroom process that keeps students and educators informed of students' progress.

Summative evaluation occurs most often at the end of a module, to determine what has been learned over a period of time.

For information about program evaluation refer to *Saskatchewan School-Based Program Evaluation Resource Book* (1989).

Module Overview

Module Code	Modules	Suggested Time (hours)
	Note: Module 1 or 2 shall be chosen as core before progressing through further modules.	
DRAF01	Module 1: Computer-Aided Drafting Basics* (see note above)	10-20
DRAF02	Module 2: Basic Manual Drafting Tools and Procedures (see note above)	10-15
DRAF03	Module 3: Sketching and Freehand Drawing Fundamentals (Optional)	5-15
DRAF04	Module 4: Multi-view Drawings (Core)	20-25
DRAF05	Module 5: Pictorial Drawings (Core)	15-20
DRAF06	Module 6: Basic Dimensioning (Core)	15-20
DRAF07	Module 7: Sectional Views (Core)	10-15
DRAF08	Module 8: Basic 3D CAD* (Optional)	5-10
DRAF09	Module 9: Auxiliary Views and Revolutions (Core)	10-20
DRAF10	Module 10: Advanced Dimensioning (Core)	5-10
DRAF11	Module 11: Fasteners and Joints (Optional)	5-10
DRAF12	Module 12: Working Drawings (Core)	15-20
DRAF13	Module 13: Floor Plans (Optional)	20-25
DRAF14	Module 14: Foundation Plans (Optional)	5-15
DRAF15	Module 15: Wall Sections (Optional)	10-20
DRAF16	Module 16: Elevations (Optional)	10-20
DRAF17	Module 17: Intermediate 3D CAD* (Optional)	10-20
DRAF18A, B	Module 18A, B: Work Study Preparation and Follow-up Activities (Optional)	5-10
DRAF19A, B	Module 19A, B: Work Study (Optional)	25-50
DRAF20	Module 20: Piping (Optional)	10-15
DRAF21	Module 21: Pattern Developments (Optional)	5-15
DRAF22	Module 22: Mapping (Optional)	10-15
DRAF23	Module 23: Electronics (Optional)	3-5
DRAF24	Module 24: Residential Design (Optional)	5-15
DRAF25	Module 25: Presentation Floor Plans (Optional)	15-25
DRAF26	Module 26: Presentation Elevations (Optional)	15-25
DRAF27	Module 27: Advanced 3D CAD* (Optional)	15-25
DRAF28	Module 28: CAD/CAM* (Optional)	20-30
DRAF29	Module 29: Surveying (Optional)	10-15
DRAF30	Module 30: Career Opportunities (Core)	2-5
DRAF31	Module 31: Reading Technical Documents (Blueprints) (Optional)	2-5
DRAF99A, B, C	Module 99A, B, C: Extended Study (Optional)	5-20

*Computer access required

Suggested Course Configuration

Module Code	Module	Suggested Time (hours)
	Note: Module 1 or 2 shall be chosen as core before progressing through further modules.	
	Drafting 10 (Introductory)	
DRAF01	Module 1: Computer-Aided Drafting Basics* (see note above)	10-20
DRAF02	Module 2: Basic Manual Drafting Tools and Procedures (see note above)	10-15
DRAF03	Module 3: Sketching and Freehand Drawing Fundamentals (Optional)	5-15
DRAF04	Module 4: Multi-view Drawings (Core)	20-25
DRAF05	Module 5: Pictorial Drawings (Core)	15-20
DRAF06	Module 6: Basic Dimensioning (Core)	15-20
DRAF07	Module 7: Sectional Views (Core)	10-15
DRAF08	Module 8: Basic 3D CAD* (Optional)	5-10
DRAF30	Module 30: Career Opportunities (Core)	2-5
DRAF99	Module 99: Extended Study (Optional)	5-20
	Total Minimum	100
	Drafting 20 (Intermediate)	
DRAF09	Module 9: Auxiliary Views and Revolutions (Core)	10-20
DRAF10	Module 10: Advanced Dimensioning (Core)	5-10
DRAF11	Module 11: Fasteners and Joints (Optional)	5-10
DRAF12	Module 12: Working Drawings (Core)	15-20
DRAF13	Module 13: Floor Plans (Optional)	20-25
DRAF14	Module 14: Foundation Plans (Optional)	5-15
DRAF15	Module 15: Wall Sections (Optional)	10-20
DRAF16	Module 16: Elevations (Optional)	10-20
DRAF17	Module 17: Intermediate 3D CAD* (Optional)	10-20
DRAF18	Module 18: Work Study Preparation and Follow-up Activities (Optional)	5-10
DRAF19	Module 19: Work Study (Optional)	25-50
DRAF99	Module 99: Extended Study (Optional)	5-20
	Total Minimum	100
	Drafting 30 (Advanced)	
DRAF18	Module 18: Work Study Preparation and Follow-up Activities (Optional)	5-10
DRAF19	Module 19: Work Study (Optional)	25-50
DRAF20	Module 20: Piping (Optional)	10-15
DRAF21	Module 21: Pattern Development (Optional)	5-15
DRAF22	Module 22: Mapping (Optional)	10-15
DRAF23	Module 23: Electronics (Optional)	3-5
DRAF24	Module 24: Residential Design (Optional)	5-15
DRAF25	Module 25: Presentation Floor Plans (Optional)	15-25
DRAF26	Module 26: Presentation Elevations (Optional)	15-25
DRAF27	Module 27: Advanced 3D CAD* (Optional)	15-25
DRAF28	Module 28: CAD/CAM* (Optional)	20-30
DRAF29	Module 29: Surveying (Optional)	10-15
DRAF31	Module 31: Reading Technical Documents (Blueprints) (Optional)	2-5
DRAF99	Module 99: Extended Study (Optional)	5-20
	Total Minimum	100

* Computer access required

Core and Optional Modules

Module 1: Computer-Aided Drafting Basics (Core if Module 2 is not selected)

Suggested time: 10 - 20 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To learn the basic functions of Computer-Aided Drafting (CAD) software.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To use computer software to produce drawings. (TL)
- To produce drawings to scale. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
1.1	To create CAD files and draw basic elements in the file. (TL)	<p>Provide a step by step procedure to create the CAD file.</p> <p>Start by drawing the fundamental elements - lines, circles, arcs, curves, and polygons. The size of the elements is not important at the start.</p> <p>Locating the tools and understanding how to use them is done through repeating the use of these tools.</p>
1.2	To manipulate elements in the CAD file. (TL)	<p>Demonstrate locating and using some of the manipulation tools such as: move, delete, copy, copy parallel/offset, rotate, mirror and extend lines. Exercises that repeat the use of these tools help students remember.</p>
1.3	To use the various view controls.	<p>Have the students examine a large detailed drawing, making them find various things on the drawing using the zoom in, zoom out, window area and pan tools.</p>
1.4	To draw elements in the design file with different symbols. (TL)	<p>Have the students draw elements with different colors, line styles, and line weights.</p> <p>Have students change the colors, line styles/types and weights of existing elements.</p>
1.5	To draw elements on different levels or layers. (TL)	<p>Students should draw elements on different levels/layers and then turn the levels/layers off and on.</p> <p>Designate certain types of lines to certain levels. E.g. object lines - level one and center lines - level two.</p>

Learning Objectives		Notes
1.6	To draw objects to an exact size. (NUM)	<p>Students should understand that in computer assisted drafting everything is drawn to its actual size.</p> <p>Demonstrate this by drawing something very small and something large in the same file.</p> <p>Start with basic elements: lines, arcs, circles, and rectangles and then combine these elements to create simple shapes.</p>
1.7	To draw a title block.	<p>It is useful to provide a step by step procedure for students to follow to make sure each student has the same title block.</p> <p>It is important that this title block is correct because it will be used for all of the students' drawings.</p> <p>Usually two sizes of title blocks are required: A4 (210 by 297 millimeters) (8 ½" x 11") and A3 (297 by 420 millimeters) (11" x 17"). As an alternative, a file containing a drawn title block could be given to each student.</p>
1.8	To print drawings. (TL)	<p>Students should be able to print to the various printers and/or plotters that are in the CAD lab.</p> <p>Students should understand that the scale in the title block determines the scale of the plotted drawing.</p> <p>Plot a few drawings at different scales 1:1, 1:2 and 1:5.</p> <p>Centering the shape in the title block will help when the student has to lay out multi-view drawings in the future.</p> <p>After the students have plotted several drawings at different scales, you can use these as examples to measure with different scales.</p>
1.9	To use a scale to measure printed drawings. (NUM)	<p>Students should be most familiar with the metric scale, but the architectural and engineers scale should also be introduced.</p>
1.10	To use terminology in context. (COM)	<p>Define terms such as: perpendicular, parallel, tangent, radius, and diameter.</p>

Module 2: Basic Manual Drafting Tools and Procedures (Core if Module 1 is not selected)

Suggested time: 10 - 15 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To use the basic manual tools traditionally used to produce drawings.
- To appreciate the concept of scale and proportion.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To use technical language to facilitate discussion of drawings. (COM)
- To explore technical skills to develop a drawing. (TL)
- To use numeracy skills to meet the demands of a specific task in drafting. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
2.1	To use a T-square, pencil, and triangle set squares. (TL)	<p>A drafting machine, arm or parallel rule may be substituted.</p> <p>Begin with how to place the drawing paper on the drawing board or desk.</p> <p>Be sure to explain that the T-square is placed with its head to the left for persons who are right handed, and to the right for persons who are left handed.</p> <p>Use tape to hold the paper in place. Avoid the use of tacks or staples.</p> <p>Explain pencil hardness and line weight, e.g. 4H, 2H, H, HB, 2B.</p> <p>Explain the use of the triangle set squares and that the T-square is never placed at the top or bottom to draw vertical lines.</p> <p>Have students draw a horizontal line and then lines at 15° increments.</p>
2.2	To use a scale to measure. (NUM)	<p>Introduce the concept of scale. (NUM)</p> <p>Show the students a variety of scales such as: metric, imperial, Engineers and Architectural. (COM)</p> <p>Explain that the scale is used to measure. It is never used to draw a line except with drafting arms or machines.</p>

Learning Objectives		Notes
2.3	To complete a title block.	Demonstrate lettering guidelines. You may wish to use a lettering guide template. You may want to have students practise some lettering.
2.4	To draw objects to an exact size.	Have students complete drawings of the front and top views of several simple blocks. Use model blocks if possible. Avoid blocks that require hidden lines or curves.

Module 3: Sketching and Freehand Drawing Fundamentals (Optional)

Adapted from Alberta CTS DES101 and used with permission.

Suggested time: 5 - 15 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To manually sketch drawings of manufactured forms.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To strengthen the students understanding of drafting through applying the use of geometric figures and straight lines. (NUM)
- To touch and manipulate a variety of materials first hand so that students may make comparisons and evaluations. (CCT)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
3.1	To draw simple geometric figures with two and three dimensions made with straight lines.	Work with familiar shapes of blocks progressing to more difficult blocks with cutouts. Stress accuracy and neatness so images will be recognizable and demonstrate a sense of proportion and scale. (NUM)
3.2	To sketch objects freehand that have two and three dimensions that do not have square edges. (CCT)	Students should be encouraged to practise their sketching outside of the classroom. Sketching skills can only be developed through practice.
3.3	To sketch multi-view drawings of geometric forms. (NUM)	Graph paper may be used to help students with their sketches, e.g., isometric grid paper for the isometric sketches and regular graph paper for the multi-view sketches. Drawing on the back of the graph paper works well. Initially, it may be helpful to provide students with models to work from, to draw their sketches.

Learning Objectives		Notes
3.4	To sketch isometric drawings of geometric forms.	Sketching can be worked into other modules by having students provide sketches of the objects before they start the final drawing on the computer.
3.5	To sketch a manufactured form.	<p>Choose a manufactured item that has painted or polished surfaces that reflect light and create highlights. Items such as bicycle derailleurs, a cutaway model of a transmission or a kitchen utensil are good choices for subject matter.</p> <p>Teachers may wish to use professionals from the community as a resource; (e.g., architects, illustrators, software designers, drafting designers, sign writers). Seeing examples of professional sketches reinforces that sketching and drawing are important employability skills.</p>

Module 4: Multi-view Drawings (Core)

Suggested time: 20 - 25 hours

Level: Introductory

Prerequisite: Module 1 or 2

Foundational Objectives

- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To appreciate the concept of scale and proportion.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the drafting of drawings. (COM)
- To use numeracy skills to meet the demands of a specific task in drafting. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
4.1	To create a multi-view drawing using orthographic projection. (TL, CCT)	<p>Students should understand that drafting is a means of communicating. Therefore, it must be done neatly and clearly. (TL)</p> <p>Start with simple objects that only require object lines. It is useful to have models of the object that students can look at and hold.</p> <p>The importance of position and alignment of the views should be emphasized.</p> <p>Next, introduce objects with hidden lines. The purpose of levels, weights, styles, and colors can be explored.</p> <p>An object with holes can be used to introduce center lines. Counterbored and countersunk holes can be introduced.</p>
4.2	To be able to explain third-angle projection drawing.	<p>Different methods to transfer details from top and side view can be explored. (CCT)</p> <p>Using a model inside a glass box helps students understand the concept of orthographic projection. (COM)</p> <p>Discuss what countries use third-angle/first-angle projection.</p>
4.3	To lay out a drawing.	<p>It is useful to give the students a formula to calculate the spaces between the views. (NUM)</p> <p>Students should understand that placement of the title block at different scales determines the scale of the plotted drawing.</p> <p>Students should be able to lay out a drawing with two or three views.</p>

Module 5: Pictorial Drawings (Core)

Suggested time: 15 - 20 hours

Level: Introductory

Prerequisite: Module 1 or 2

Foundational Objectives

- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To appreciate the concept of scale and proportion.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To produce pictorial drawings. (TL)
- To use the language and terms specific to the drafting of drawings. (COM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
5.1	To produce isometric drawings. (TL)	<p>Define, explain and show illustrations of isometric drawings.</p> <p>Start with objects that will require only isometric lines to draw.</p> <p>Then draw objects with some non-isometric lines. Show how the non-isometric lines are not parallel to any of the isometric axis. (NUM)</p> <p>Objects containing circles and arcs can be drawn once the basics have been mastered.</p>
5.2	To produce oblique cavalier drawings.	<p>Define, explain and show illustrations of oblique cavalier drawings.</p> <p>Start with objects that will require only straight lines.</p> <p>Student should understand that circles and arcs should be placed on the front plane of the oblique drawing so they are not distorted.</p>
5.3	To produce oblique cabinet drawings. (COM)	<p>Define, explain and show illustrations of cabinet drawings.</p> <p>When arcs and circles appear on more than one plane it is better to use an isometric drawing.</p> <p>The face of the object with the longest dimensions should be placed parallel to the front plane.</p>

Module 6: Basic Dimensioning (Core)

Suggested time: 15 - 20 hours

Level: Introductory

Prerequisite: Module 1 or 2

Foundational Objectives

- To be able to describe size on a multi-view drawing.
- To be able to use and understand the terminology related to drafting.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To choose an appropriate scale ratio for drawings. (NUM)
- To develop knowledge of the use of technology in the field of drafting. (TL)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
6.1	To use terminology in context. (COM)	Define: extension lines; dimension lines; arrowheads; leaders; diameter symbols; radius symbols; and, aligned and unidirectional dimensioning.
6.2	To apply dimensions. (NUM, TL)	<p>When using CAD software, the scale of the final plotted drawing will determine the size of the text to be used and the distances dimension lines are placed from the object. Therefore the title block must be placed before dimensioning starts.</p> <p>Start by dimensioning drawings that will be plotted at a scale of 1:1. (NUM)</p> <p>Start with simple objects that only have straight lines that require only overall dimensions.</p> <p>Next, introduce objects that require intermediate dimensions.</p> <p>Then, introduce dimension objects with simple holes, arcs and cylinders using leaders and the correct symbols. (TL)</p> <p>Discuss both aligned and unidirectional dimensioning but use only unidirectional dimensioning to avoid confusion.</p>
6.3	To use proper standards or rules for dimensioning objects. (CCT)	<p>The rules for dimensioning should be introduced as the students go through the steps of dimensioning.</p> <p>Students should understand that there is always more than one way to dimension each object, but usually one way is better than the others.</p> <p>Important rules should be emphasized, such as: try to group dimensions; place dimensions between the views; never dimension hidden lines; dimension to the center of arcs and circles; dimension circles with a diameter symbol; dimension arcs with a radius symbol; try not to use long extension lines; try not to cross extension lines; and, the correct placement of leaders.</p>

Module 7: Sectional Views (Core)

Suggested time: 10 - 15 hours

Level: Introductory

Prerequisite: Module 1 or 2

Foundational Objectives

- To be able to describe shape in a multi-view drawing.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To learn terminology used in the drafting industry and use said terminology in context. (COM)
- To use appropriate scale ratios when producing drawings. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
7.1	To discuss the purpose of sectional views.	Models are useful to show what the interior of some objects looks like by cutting away part of the object. (NUM) Hidden lines can become confusing when the drawing is complicated. Provide several examples when discussing hidden lines.
7.2	To produce sectional drawings. (NUM)	Start with full sections. Keep the objects simple. Use some objects that have ribs and webs. Introduce the symbols for cutting plane lines and section lines. (COM)
7.3	To produce several types of sectional drawings.	Explore the methods used to hatch or pattern an area. A model is useful to help show which areas need to be hatched. Have students complete at least one full section, half section, and offset section. (COM) Other types of sections can be done, if time allows.

Module 8: Basic 3D CAD (Optional)

Suggested time: 5 - 10 hours

Level: Introductory

Prerequisite: Module 1

Foundational Objectives

- To create drawings of basic objects in a three dimensional (3D) environment.
- To learn the basic functions of Computer-Aided Drafting (CAD) software.

Common Essential Learnings Foundational Objectives

- To understand and use standard drawing protocols when producing 3D drawings. (TL)
- To use the concept of scale while producing drawings. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
8.1	To create a 3D file.	Students should understand the difference between a 3D file and a 2D file when using CAD software. When working with 3D CAD software, it is better to think of it as building the object. (TL) The steps to create a 3D file will vary depending on the program used.
8.2	To produce a slab or a block in a 3D file. (TL, NUM)	Start with a simple block or slab.
8.3	To create holes in the slab or block.	Then progress to objects with holes, protrusions and cuts. Keep the objects simple.
8.4	To create protrusions and cut on the slab or block.	Producing drawings of the same objects used in the multi-view module and the pictorial module helps students understand the differences between the three methods of representation. (NUM)

Module 9: Auxiliary Views and Revolutions (Core)

Suggested time: 10 - 20 hours

Level: Intermediate

Prerequisite: Modules 1 or 2 and 4

Foundational Objectives

- To be able to describe shape in a multi-view drawing.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To use numeracy skills while producing auxiliary view drawings. (NUM)
- To understand the difference between auxiliary views and revolutions. (CCT)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
9.1	To produce auxiliary view drawings. (TL, NUM)	<p>Students must first be able to identify the view that has the edge view of the inclined surface.</p> <p>Start with objects that have only straight lines. Objects with arcs and curves can be drawn once the straight line objects have been mastered. (NUM)</p> <p>Define auxiliary plane and truncated. (COM)</p>
9.2	To add dimensioning to the drawings. (CCT)	<p>Adding dimensions to the drawing will help show the students that the auxiliary view gives the correct shape and size of the inclined surface.</p>
9.3	To produce secondary auxiliary views. (Optional)	<p>Once primary auxiliary views have been mastered then secondary auxiliary views can be introduced. Keep the objects very simple. (TL)</p>
9.4	To produce drawings using the revolution process.	<p>The difference between auxiliary views and revolutions should be discussed. Although the results are the same, the process of doing the two types of drawings should be emphasized.</p>

Module 10: Advanced Dimensioning (Core)

Suggested time: 5 - 10 hours

Level: Intermediate

Prerequisites: Module 6

Foundational Objectives

- To be able to describe shape in a multi-view drawing.
- To maintain a high standard of quality for drawings produced.
- To become aware of the career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To create drawings that demonstrate an understanding of the conventions of dimensioning and drawing symbols. (TL)
- To become familiar with abbreviations and how to use them. (COM)
- To use numeracy to meet the demands of dimensioning. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
10.1	To place notes with and without leaders. (COM)	An example of a note without a leader would be: Note all fillets and rounds 3mm.
10.2	To dimension counterbored and countersunk holes. (TL)	It should be an expectation that when the drawing is completely dimensioned all size descriptions are clearly and easily read. The dimensioning standards set out by the CSA should be followed.
10.3	To dimension angles and chamfers.	When using CAD software, the computer can not always place the dimensions so they are most easily read; it is important that students understand that moving and manipulating dimensions is part of dimensioning. (CCT)
10.4	To use geometric tolerances. (NUM) To dimension non-circular curves.	Explain where tolerances are used and the reason for tolerances. If possible, have a machinist come in and speak to the class.
10.5	To use abbreviations correctly. (COM)	
10.6	To dimension assembly drawings.	Note: teachers should refer to a resources list.
10.7	To use finish symbols.	
10.8		

Module 11: Fasteners and Joints (Optional)

Suggested time: 5 - 10 hours

Level: Intermediate

Prerequisites: Module 1 or 2

Foundational Objectives

- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To be able to describe size on a multi-view drawing.
- To be able to describe shape in a multi-view drawing.

Common Essential Learnings Foundational Objectives

- To learn related vocabulary and use it in context. (COM)
- To create drawings that demonstrate an understanding of fasteners. (TL)
- To understand the concept of scale drawing. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
11.1	To identify metric screw threads, square threads and acme threads. (NUM)	Students should understand the relationships between the major diameter of the threads and the size of the head of the bolt.
11.2	To identify hex head bolts and square head bolts. (COM)	Have lots of example of different types of fasteners that the students can hold and examine.
11.3	To draw both views of a hex head bolt or nut.	The top view and side view are all that is required.
11.4	To draw thread representation using either schematic or simplified methods. (TL)	Once the different methods of representing the fasteners have been mastered, then display drawings showing how the fasteners might be used and can be drawn.
11.5	To recognize metric thread designation and be able to state the components of the designation. (COM)	Students should be made aware that there are hundreds of different types of fasteners, and only a very few are actually drawn in this module. (TL)
11.6	To identify different wood joints. (COM)	Examine different wood joints used in cabinet making.
11.7	To place basic welding symbols on a drawing. (COM)	Examine different joints used in welding.

Module 12: Working Drawings (Core)

Suggested time: 15 - 20 hours

Level: Intermediate

Prerequisites: Module 1 or 2, 4, 7, 9, and 10

Foundational Objectives

- To be able to produce simple working drawings for mechanical projects.
- To be able to describe size on a multi-view drawing.
- To be able to describe shape in a multi-view drawing.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To learn related vocabulary and use it in context. (COM)
- To use numeracy skills to meet the demands of a specific task in drafting. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
12.1	To determine the correct views to draw for each part.	Select an assembly of parts that are not too complicated. (CCT) Work from an exploded pictorial view that shows the order of assembly.
12.2	To determine the correct type of drawing required to describe each part accurately.	If you have the actual object they are going to draw, this really helps students to visualize. Discuss with the students the assembly of parts and the function of the parts. (COM) Discuss which parts require sectional views, auxiliary views and the number of views. (PSVS)
12.3	To draw and dimension each part.	Most working drawings do not include fasteners in the drawing but you might want to include them.
12.4	To lay out the parts in a title block. (NUM)	
12.5	To draw an assembly drawing that shows all the parts. (TL)	Discuss with the students the number of views required to show all the parts. Discuss whether a sectional view is required.
12.6	To label all the parts. (COM)	If there are a number of pieces, a description of the parts relationship is needed.
12.7	To create a parts list or a bill of material.	

Module 13: Floor Plans (Optional)

Suggested time: 20 - 25 hours

Level: Intermediate

Prerequisites: Module 1 or 2, 4 and 6

Foundational Objectives

- To be able to produce drawings for architectural projects.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To learn related vocabulary and use it in context. (COM)
- To create drawings that demonstrate an understanding of the drawing tools, and drawing symbols. (TL)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
13.1	To draw exterior walls.	<p>Have students select the house they are going to draw from a predetermined list that has the following considerations: a bungalow, no fireplaces, no brick façade, and a relatively simple roof design. (COM)</p> <p>List a variety of houses with different levels of complexity.</p> <p>Plans that have walls at angles should be done by more advanced students. Display several examples of floor plans done by professionals.</p>
13.2	To place interior partitions.	<p>Presentation drawings usually have only overall dimensions and room sizes; therefore, students must first determine location of all the walls.</p> <p>Minimum and typical sizes of rooms and halls and closets must be discussed in order for students to be able to locate walls. (CCT)</p>
13.3	To place stair and balcony handrails.	Review building code requirements for proper height.
13.4	To place doors and windows.	Cells/Blocks can be used for many of the symbols used on the floor plan. (COM)
13.5	To place counters.	
13.6	To place plumbing fixtures.	Plumbing fixtures shown on the plan include: toilets, sinks, showers, and tubs. (TL)
13.7	To place shelves and rods.	

Learning Objectives		Notes
13.8	To place the appliances.	Appliances to be placed include: dishwashers, washing machines, dryers, fridges and stoves. (TL)
13.9	To place the stairs.	Review terminology used in stair construction.
13.10	To place the room names.	
13.11	To place the electrical symbols.	Electrical symbols to be placed include: 120 plugs, 220 plugs, lights and switches.
13.12	To dimension exterior and interior.	Switches should be connect to the lights with long dashed curved lines to indicate which lights are controlled by which switches.
13.13	To place section symbols.	

Module 14: Foundation Plans (Optional)

Suggested time: 5 - 15 hours

Level: Intermediate

Prerequisites: Module 13

Foundational Objectives

- To be able to produce drawings for architectural projects.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objective

- To use appropriate scale ratios when producing drawings. (NUM)
- To develop an understanding of the value and use of technology in the field of drafting. (TL)

	Learning Objectives	Notes
14.1	To place foundation walls. (TL)	This will be an unfinished basement.
14.2	To place the footings. (COM)	Location of foundation walls and footings are the primary concern.
14.3	To place the stairs. (TL)	Preserved wood foundations can be discussed and drawn as they are being constructed in your area.
14.4	To determine the size of the beam or beams. (NUM)	Using a simple rectangular house, explain the calculations to determine the built-up beam sizes and number of posts required. Each column in the tables used to do the calculations should be discussed.
14.5	To determine the number of posts.	Different types of beams and joists can also be discussed, i.e., engineered joists and beams.
14.6	To determine the size of the floor joists.	
14.7	To place the windows.	Review building code requirements regarding window size.
14.8	To dimension the foundation plan. (NUM)	

Module 15: Wall Sections (Optional)

Suggested time: 10 - 20 hours

Level: Intermediate

Prerequisite: Module 13

Foundational Objectives

- To be able to produce drawings for architectural projects.
- To maintain a high standard of quality for drawings produced.
- To understand the use and location of materials used in the construction of a typical house.
- To become aware of career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To use technical vocabulary and use it in context. (COM)
- To use numeracy skills to meet the demands of a specific task in drafting. (NUM)
- To create drawings that demonstrate an understanding of the drawing tools, and drawing symbols. (TL)
- To employ the use of numeracy to gain practical employment skills. (NUM)

Learning Objectives		Notes
15.1	Draw a typical wall section.	<p>The first wall section drawn should be generic in type.</p> <p>It is not necessary to draw a full building section. (NUM)</p> <p>Drawing the first wall section with the students as a group works well. (PSVS)</p> <p>Start at the footing and work your way up discussing the materials and construction methods as you go. (COM)</p>
15.2	Label a typical wall section. (COM)	Custom line styles used for the batt insulation can be introduced.
15.3	Use the correct symbols for the materials used in construction. (COM)	<p>Patterning and hatching areas can be introduced.</p> <p>It should be discussed how different line weights or widths affect the presentation of the drawing.</p> <p>Use either concrete foundation or wood, but discuss the differences between the two.</p>
15.4	Describe some of the different construction variations.	<p>Use either trusses or rafters or roof joists, but discuss the differences. (COM)</p> <p>A field trip to a house or several houses under construction is very beneficial.</p> <p>Consider having a local builder as a guest speaker, if a field trip is not feasible.</p> <p>Discuss R2000 building specifications.</p>
15.5	Draw a completed wall section to scale. (NUM)	

Module 16: Elevations (Optional)

Suggested time: 10 - 20 hours

Level: Intermediate

Prerequisite: Module 13

Foundational Objectives

- To be able to produce drawings for architectural projects.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objective

- To use numeracy skills to meet the demands of a specific task in drafting. (NUM)
- To create drawings that demonstrate an understanding of the drawing tools, and drawing symbols. (TL)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
16.1	To draw the front and side elevations for a bungalow. (TL, NUM)	<p>Discuss different types of roofs. (COM)</p> <p>Lay out the roof in a simple roof plan, i.e. peaks and valleys. (TL)</p> <p>Use the roof layout to locate overhangs and peaks and valleys on the elevation.</p> <p>Use the floor plan to locate wall locations and windows and doors location on the elevation.</p>
16.2	To label materials used to finish the exterior of the house. (COM)	<p>Field trips to residential construction sites are useful to show students the different materials used in finishing the exterior of a house.</p> <p>Discuss the different materials used to finish the exterior of a house and how they are represented on the elevations.</p> <p>Discuss door and window styles used in modern homes.</p>
16.3	To label the significant elevations (e.g., top of footing, top of subfloor, etc.).	Use the wall section or building section to locate the different elevations such as top of subfloor and top of wall. (COM)

Module 17: Intermediate 3D CAD (Optional)

Suggested time: 10 - 20 hours

Level: Intermediate

Prerequisite: Module 8

Foundational Objectives

- To create drawings of basic objects in a three dimensional (3D) environment.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To use computer software to produce 3D models. (TL)
- To learn technical terms associated with 3D models. (COM)

Note: other CELs may be emphasized.

Learning Objectives		Notes
17.1	To produce models in a 3D CAD environment. (TL, NUM)	Introduce the more advanced tools in order to create more complex models. Explore models created using revolutions. Discuss 3D surfaces and 3D solids.
17.2	To add materials to the objects in the 3D CAD environment. (CCT)	Counterbored and countersunk holes may be added to the models.
17.3	To add lighting to the 3D CAD environment.	Demonstrate the steps involved when adding materials to the models. Demonstrate the steps involved when adding lighting to the models. Examples of different types and placements of lights can be explored.
17.4	To print the rendered image of the models. (TL)	
17.5	To maintain a portfolio of completed drawings.	

Module 18A, B: Work Study Preparation and Follow-up Activities (Optional)

This module is used to prepare students for work study placement. Foundational Objectives include pre-placement information, preparation for interviews, and expectations for the workplace experience.

Suggested time: 5 - 10 hours

Level: Intermediate and Advanced

Foundational Objectives

- To be aware of the careers and opportunities in the field of drafting that exist in Saskatchewan and other provinces.
- To integrate classroom learning with work-related learning.
- To increase awareness of employability skills as they relate to the work environment.

Common Essential Learnings Foundational Objectives

- To foster an effective use of communication skills in the workplace. (COM)
- To engage in a work study experience and develop entry level workplace skills that may lead to sustainable employment. (PSVS)
- To expand career research beyond the classroom setting. (IL)

Learning Objective		Notes
18.1	To become aware of the expectations of each of the partners in the work study component. (PSVS)	<p>In order to establish a successful working relationship with all of the partners involved in the workplace, it is important to define the expectations of each partner.</p> <p>Refer to Guidelines for Work Study, a section of <i>the Practical and Applied Arts (PAA) Handbook</i> (Draft 2000) for the expectations of business, student, teacher monitor, and school.</p>
18.2	To determine factors that would affect the student contribution in the workplace. (CCT)	<p>The students may formulate a list of what they can bring to the workplace and how each may impact on their jobs.</p> <ul style="list-style-type: none">• school subjects• past experiences• self-concept and personality• needs, values and interests• knowledge, skills and attitudes• career goals and plan <p>Ask students to do a self-assessment of skills using the influences in the above list as a guide. Students should identify strengths they can offer community partners. Try to incorporate the value of communication and teamwork in the discussion.</p>
18.3	To foster an awareness of building good communication in the workplace. (COM)	<p>Discuss verbal and non-verbal communication. List some ways in which negative non-verbal communication may be displayed. Encourage students to role play ways of demonstrating effective techniques of verbal communication on the job when giving or receiving instructions, and resolving conflict. With the use of case studies, divide the students into groups and role play to show how effective use of communication can resolve conflict on the job.</p>

Learning Objectives	Notes
18.4 To develop a resumé that may be forwarded to a potential employer.	<p>The student will develop a resumé using the correct format. (IL)</p> <p>The resumé may be used to introduce the student to the employer of a workplace site prior to an interview. Teachers are encouraged to work with other staff members to ensure resumé preparation is taught. Resumé writing is suggested in <i>English Language Arts 20 and A30, Information Processing 10, 20, 30, and Career and Work Exploration 20</i>.</p> <p>Students should save the resumé on a computer disk and update it, as changes need to be made and references are added.</p>
18.5 To determine student guidelines in preparation for an interview. (COM)	<p>Through class or small group discussions, students may list guidelines for an interview. The instructor may add missing items to the list.</p> <p>Outline and describe the three stages of an interview. Point out to the students at what stage of the interview each of the guidelines previously discussed will be used.</p> <p>The greeting involves an introduction between the student and employer. Discuss or demonstrate how this should be done.</p> <p>The exchange is the longest part of the interview where the employer asks a series of questions and engages in a dialogue with the student about information on the resumé and other matters relating to the job.</p> <p>The parting provides closure to the interview and may be just as important as the greeting. Explain how this may be done.</p> <p>Provide the students with a list of questions frequently asked by employers or ask students to make a list. Students may role play the stages of the interview.</p>
18.6 To discuss the post interview.	<p>After the student has completed the interview with the employer, do a follow-up activity. Review the interview with the student using the three stages above as points for discussion.</p>

Learning Objectives	Notes
18.7 To develop a procedural guide for the work site.	<p>Discuss the following work site items with students.</p> <ul style="list-style-type: none">• transportation• hours of work• absence and tardiness• procedures for conflict resolution• role of the student, teacher, and work place supervisor• dress code• job description• school and employer expectations
18.8 To relate feedback from the work placement.	<p>Students provide feedback about work placement including: where they were placed, type of business, duties, most rewarding experience, most difficult situation, and how they handled it.</p> <p>Note: It is recommended that each student send a thank you note or card to the employer upon the completion of each work placement. If more than one placement has been made in the course, follow-up activities must be completed after each placement.</p> <p>Ensure that students understand these guidelines by asking students to describe each of these items.</p> <p>Note: Look for opportunities to introduce and reinforce ideas about Labour Standards, Occupational Health and Safety, and WHMIS. Use the <i>Career and Work Exploration Curriculum Guide</i>, the <i>PAA Handbook</i>, the Saskatchewan Labour website (http://www.readyforwork.sk.ca), and other recommended resources.</p>

Module 19A, B: Work Study (Optional)

Suggested time: 25 - 50 hours

Level: Intermediate and Advanced

Prerequisite: None

Foundational Objectives

- To be aware of the careers and opportunities in the field of drafting that exist in Saskatchewan and other provinces.
- To integrate classroom learning with work-related learning.
- To increase awareness of employability skills as they relate to the work environment.

Common Essential Learnings Foundational Objectives

- To engage in a work study experience and develop entry level workplace skills that may lead to sustainable employment. (PSVS)
- To expand career research beyond the classroom setting. (IL)

For more information about implementing work study in schools see the Work Study Guidelines for the Practical and Applied Arts included in the *Practical and Applied Arts Handbook* (Draft 2000). Teachers need to use or design appropriate learnings objectives for this module; for instance, to demonstrate ability to follow a “Training Plan”.

Note: Consult the renewed/new *Career and Work Exploration Curriculum Guide* and the Department of Labour for content about Labour Standards, Occupational Health and Safety, and WHMIS. If you offer several work studies during grade 11 or 12 in a course series, add more depth to the next experience.

Module 20: Piping (Optional)

Suggested time: 10 - 15 hours

Level: Advanced

Prerequisite: Modules 1 or 2, 4, 5, 6 and 10

Foundational Objectives

- To be able to use and understand the terminology related to drafting.
- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To be able to describe size on a multi-view drawing.
- To be able to describe shape in a multi-view drawing.
- To become aware of the career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To learn technical terms associated with piping drawings. (COM)
- To produce piping drawings to scale. (NUM, TL)

Note: other CELs may be emphasized here.

	Learning Objectives	Notes
20.1	To develop an understanding of: a) the different kinds of pipe (COM) b) the different uses for pipe c) the different joints valves and fittings used in piping. (TL)	Cells or blocks can be used for the different joints and valves. Students can make them or the teacher may have some prepared for them. A field trip to local refinery, building or construction site is recommended. (PSVS) Only one or two types of pipe fittings should be used in the drawings.
20.2	To draw single line multi-view piping drawings. (TL)	Students may convert double line piping drawings into single line drawings. (NUM)
20.3	To draw single line isometric piping drawings.	Tanks and vessels can be drawn as simple cylinders.
20.4	To dimension piping drawings.	
20.5	To use terminology in context. (COM)	

Module 21: Pattern Developments (Optional)

Suggested time: 5 - 15 hours

Level: Advanced

Prerequisites: Modules 1 or 2, 4 and 9

Foundational Objectives

- To be able to use and understand the terminology related to drafting.
- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To be able to describe size on a multi-view drawing.
- To be able to describe shape in a multi-view drawing.
- To become aware of the career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To learn related vocabulary and use it in context. (COM)
- To create drawings that demonstrate an understanding of drawing tools and symbols. (TL)
- To use numeracy skills to meet the demands of a specific task in drafting. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
21.1	To list different industries that use surface developments. (COM)	A field trip to a local company that makes use of surface developments is recommended.
21.2	To draw developments. (TL, NUM)	<p>Students should produce pattern developments for a rectangular prism; a truncated rectangular prism; a truncated cylinder; a cone; a pyramid; a rectangular to round transition piece; and an oblique pyramid. (NUM)</p> <p>Start with straight line developments for the rectangular prism and truncated rectangular prism.</p> <p>Then add parallel line development for the cylinders.</p> <p>Then do radial line development for the pyramids and cones.</p> <p>Students should draw or plot some of the patterns on cardboard in order to construct the objects.</p>

Module 22: Mapping (Optional)

Suggested time: 10 - 20 hours

Level: Advanced

Prerequisite: Module 1 or 2, 4 and 6

Foundational Objectives

- To be able to use and understand the terminology related to drafting.
- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To be able to describe size on a multi-view drawing.
- To be able to describe shape in a multi-view drawing.
- To become aware of the career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To learn technical terms associated with mapping. (COM)
- To be able to interpret topographical and cadastral maps. (CCT)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
22.1	To become familiar with the symbols used in mapping. (COM)	Use examples of topographical and cadastral maps from the local area so students can recognize familiar features. Discuss terminology such as spot height, contour lines, contour interval, elevation, meridian, township and range, and azimuth. (COM)
22.2	To be able to find a location on a map given the legal description. (CCT)	
22.3	To produce a simple topographical map. (TL)	Discuss the National Topographic System. Restrict the features on the topographical map to only contour lines and hydrography. (CCT)
22.4	To produce a simple cadastral map.	Restrict the features on the cadastral map to property lines and the associated information.
22.5	To use terminology in context. (COM)	Plan a field trip to see the use of Geographic Information Systems (GIS) as it relates to mapping. Discuss other uses of GIS in the areas of mapping such as highways and roads or subdivisions.

Module 23: Electronics (Optional)

Suggested time: 3 - 5 hours
Prerequisite: Modules 1 or 2

Level: Advanced

Foundational Objectives

- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To become aware of the career opportunities that exists in the field of drafting.

Common Essential Learnings Foundational Objective

- To learn technical terms associated with electronics. (COM)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
23.1	To become familiar with the symbols used in electronics. (COM)	Use examples of circuits or pictorial drawings of circuits to help understand the schematic representations.
23.2	To produce simple schematic drawings of an electronic circuit. (TL)	Circuits made in an electronics class could be used as a model for drawing.
23.3	To use terminology in context. (COM)	The actual circuit's purpose may be demonstrated if you have an example from an electronics class.

Module 24: Residential Design (Optional)

Suggested time: 5 - 15 hours

Level: Advanced

Prerequisite: Modules 13, 14, 15, and 16

Foundational Objectives

- To understand the use and location of materials used in the construction of a typical house.
- To be able to use and understand the terminology related to drafting.
- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To become aware of the career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To be aware of what constitutes good functional design. (CCT)
- To increase an understanding of scale. (NUM)
- To analyze specific residential needs and recognize that there are different solutions required to complete drafting assignments. (CCT)

Note: other CELs may be emphasized here.

Learning Objectives		Notes
24.1	To understand the elements and principles of residential design. (TL, CCT)	<p>It is useful if the students have certain criteria that have to be followed, such as maximum square footage, number of bedrooms etc. The final design must also be within the student's ability to draw both plans and elevations.</p> <p>For additional information refer to Modules 1 and 2 in the <i>Design Studies 10, 20 Curriculum Guide</i>.</p>
24.2	To divide up a home into zones within a living space; living, sleeping and service. (NUM)	<p>Discuss how kitchen and bathroom design are a very important part of residential design. (CCT)</p> <p>For additional information refer to Module 3 in the <i>Housing 30 Curriculum Guide</i>.</p>
24.3	To understand how the family needs can influence housing design.	<p>Family makeup can influence design. A family composed of two working adults will have different needs than a family with young children. (CCT)</p> <p>For additional information see Module 1 in the <i>Housing 30 Curriculum Guide</i>.</p>
24.4	To understand how traffic patterns affect the design.	<p>Discuss work and traffic patterns. (CCT)</p>

Learning Objectives		Notes
24.5	To coordinate exterior design with the interior design. (CCT)	<p>Discuss the different exterior styles. Refer to Module 5 in the <i>Housing 30 Curriculum Guide</i> for more information.</p> <p>Take students on a field trip to newer and older residential areas to study exterior design and/or a field trip to a show home to see contemporary interior design.</p> <p>Discuss ways that exterior design can compliment the interior design of the home.</p> <p>Discuss how building materials affect design.</p> <p>Students can begin by sketching the home where they live.</p> <p>Plumbing fixtures should be in the same part of the house for reasons of economy.</p> <p>Keep the activity simple and avoid grandiose indoor pools, hot tubs, etc.</p>
24.6	To discuss orientation of the house on the lot.	<p>Discuss orientation on the lot as a design consideration. A house with western exposure may necessitate placing the bedrooms on the east to prevent evening heating etc. A pie shaped lot may result in a very large or small rear yard, etc.</p> <p>Refer to Module 3 in the <i>Housing 30 Curriculum Guide</i>.</p>
24.7	To produce sketches to describe a personal design. (TL, CCT, NUM)	<p>Refer to Modules 6, 9, and 10 from the <i>Housing 30 Curriculum Guide</i>.</p>

Module 25: Presentation Floor Plans (Optional)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Modules 13, 14, 15 and 16

Foundational Objectives

- To appreciate the concept of scale and proportion.
- To be able to use and understand the terminology related to drafting.
- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To become aware of the career opportunities that exists in the field of drafting.
- To be able to produce drawings for architectural projects.

Common Essential Learnings Foundational Objectives

- To use technical symbols appropriately. (CCT)
- To produce drawings in an appropriate scale. (NUM)

Note: other CELs may be emphasized here.

Learning Objectives	Notes
25.1 To produce a presentation floor plan from a design sketch.	<p>Students may produce presentation floor plans from the designs sketches produced in previous modules or from a selection provided by the teacher. The floor plan should depict exterior walls, interior partitions, doors, windows, fixtures, appliances, cupboards, stairways, steps, and landscape details. (TL)</p> <p>This may be a separate project or part of an overall presentation drawing, which will include plans, elevations, titles, and design features. (NUM)</p> <p>The differences between presentation floor plans and working drawings should be stressed. The presentation drawing is almost an artistic representation of the floor plan rather than a technical drawing. It should be easily understood. Presentation floor plans are not working drawings. They are drawings used to sell a plan to a prospective client. An example would be the plans shown in house plan magazines. (CCT, PSVS)</p> <p>By placing some landscaping (e.g., part of the side walk and some bushes, etc.) around the house the plan becomes more easily interpreted.</p> <p>Discourage students from elaborate floor plans with hot tubs, indoor pools, etc.</p> <p>Display examples of what is expected and display student work whenever it is available.</p>

Learning Objectives		Notes
25.2	To present the finished product to an audience. (PSVS)	<p>Have small groups of students share their work. This can be very informal or structured as a final “showing”. It is useful to have meetings of small groups to talk about work as it progresses. This alleviates some anxieties and students learn a great deal from each other.</p> <p>Students should recognize that a good floor plan is one that is functional, affordable, and matches the needs of the proposed occupants. (PSVS)</p>

Module 26: Presentation Elevations (Optional)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Modules 13, 14, 15 and 16

Foundational Objectives

- To appreciate the concept of scale and proportion.
- To use and understand the terminology related to drafting.
- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To produce drawings for architectural projects.

Common Essential Learnings Foundational Objectives

- To learn the use technical symbols and drawing conventions. (TL, NUM)
- To take pride in their work. (PSVS)

Learning Objectives		Notes
26.1	To produce presentation elevations from a design sketch.	<p>Students may produce presentation elevations from the designs sketches produced in the residential design module or from a selection provided by the teacher. Presentation elevations should include the wall and roof of the design from two orthogonal views; windows and doors; various visible exterior materials; basic shade and shadow; and, plants and trees. (TL, NUM, IL)</p> <p>This may be a separate project or part of a set of presentation drawings, which include floor plans, elevations, titles, and design features.</p> <p>The differences between presentation elevations and working drawings should be stressed. The presentation drawing is almost an artistic representation rather than a technical drawing and should be easily understood.</p> <p>Landscaping details (e.g., part of the side walk and some bushes etc.) and light and shadow greatly enhance elevation drawings.</p>
26.2	To present the finished product to an audience. (COM, PSVS)	<p>Have small groups of students share their work. This can be very informal or structured as a final “showing”. It is useful to have meetings of small groups to talk about work as it progresses. This alleviates some anxieties and students learn a great deal from each other.</p>

Module 27: Advanced 3D CAD (Optional)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Module 17

Foundational Objectives

- To create drawings of basic objects in a three dimensional (3D) environment.
- To maintain a high standard of quality for drawings produced.

Common Essential Learnings Foundational Objectives

- To use computer software to produce 3D models. (TL)
- To learn technical terms associated with 3D models. (COM, TL)

Learning Objectives		Notes
27.1	To produce project models in a 3D CAD environment. (TL)	<p>One major project from a previous module may be selected and transformed into a 3D model.</p> <p>If a house is selected, only the outside or a few of the rooms from the inside should be attempted. (CCT)</p> <p>If a piping project is selected, valves should be simplified.</p> <p>If a mapping project is selected, a relatively small area with dramatic elevation changes works best.</p> <p>An electronic project may be converted to a 3D model. It is recommended that students should have some electronic background, if they make such a choice. (TL, NUM)</p>
27.2	To add materials to the project in the 3D CAD environment.	
27.3	To add lighting to the 3D CAD environment.	
27.4	To produce a fly-through presentation of the finished project. (TL)	Discuss the steps for the creation of the fly-through presentation.
27.5	To maintain an electronic portfolio of completed drawings. (TL)	Caution students to back-up their files and to include electronic files in their portfolio.

Module 28: CAD/CAM (Optional)

Suggested time: 20 - 30 hours

Level: Advanced

Prerequisite: Modules 1 or 2, 6, 7, 9, and 10

Foundational Objectives

- To create drawings of basic objects in a three dimensional (3D) environment.
- To maintain a high standard of quality for drawings produced.
- To understand the use of the different tools used in drafting.

Common Essential Learnings Foundational Objectives

- To learn technical terms associated with CAD/CAM. (COM, TL)
- To understand how a computer can control the machining equipment. (TL)

Learning Objectives		Notes
28.1	To create a drawing of an object that will be made using CAM. (TL)	This module really shows the students a more complete picture of the manufacturing process.
28.2	To create the object using a CNC mill or lathe (optional). (TL, NUM)	Students can be placed in teams or groups to create the final product. (PSVS) Some of the students may have experience in machining and can be of assistance to those that do not have this background.
28.3	To use terminology in context. (COM)	A field trip to a machine shop or manufacturing facility is recommended.

Module 29: Surveying (Optional)

Suggested time: 10 - 15 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To understand the use of different tools used in surveying.
- To appreciate the concept of scale and proportion.
- To be able to understand the terminology of surveying.

Common Essential Learnings Foundational Objectives

- To learn the basic technical terms and skills associated with surveying. (COM)
- To use numeracy skills to measure and calculate required sizes and shapes for surveying. (NUM)
- To understand the use of surveying technology and its application in the world around us. (TL)

Learning Objectives		Notes
29.1	To become familiar with latitude and longitude. (COM)	Use a globe as an example of the parallels of latitude and the meridians of longitude.
29.2	To be able to identify the difference between magnetic north and true north.	Discuss how true north is the earth's geographic pole and magnetic north is the direction a free magnet responds to the earth's magnetic pull.
29.3	To become familiar with both bearing and azimuth. (COM)	Calculate various bearings with quadrants. (NUM)
29.4	To be able to plot deflection angles on both an open traverse and closed traverse. (NUM)	Plot out a closed traverse using deflection plotting. Plot out a closed traverse using bearing plotting.
29.5	To be able to find angles between bearings.	Calculate angles between two bearings: with one quadrant, two quadrants, three quadrants and four quadrants.
29.6	To understand the vernier scale on a drafting machine. (TL)	Relate the vernier of the drafting machine to the vernier on a transit.
29.7	To be able to set up and use surveying equipment.	Level the transit/level in various grades or locations. Practise holding the surveyors rod plumb.

Learning Objectives		Notes
29.8	To understand the basic terms associated with the leveling process. (COM)	Use benchmark, temporary benchmark, height of instrument, back sight, foresight, turning point, station point, and evaluations.
29.9	To be able to sight levels using engineer's level/transit and rod.	Use different objects to sight their heights.
29.10	To be able to find unknown elevations and enter the readings into field notes.	Start from a known elevation at the benchmark. Establish various backsights and foresights to establish unknown elevations. Enter all readings into field notes.
29.11	To plot out a lot. (NUM)	Plot out a lot in a wide open field space with stakes and a steel tape.

Module 30: Career Opportunities (Core)

Suggested time: 2 - 5 hours

Level: Introductory

Prerequisite: None

Foundational Objective

- To become aware of the career opportunities that exist in the field of drafting.

Common Essential Learnings Foundational Objectives

- To identify personal interests and aptitudes in order to initiate career exploration. (IL, PSVS)
- To evaluate ideas related to career choices. (CCT)
- To develop technological skills to access career information. (TL, IL)

Learning Objectives

Notes

- 30.1 To develop a list of career opportunities related to the field of drafting. (COM)

Students may list the many different career opportunities in the professional, semi-professional, and skilled trade areas related to the field of drafting. They should begin by listing all of the guest speakers who have made presentations throughout the course, then list workers within the field of drafting in the community. Students are encouraged to use a variety of sources of information such as guidance counselors, career software packages, personal interviews, and websites.

- Mechanical Draftsperson
- Architect
- Engineer
- Architectural Draftsperson
- Civil Draftsperson
- Surveying
- Mapping Draftsperson
- Utility mapping Draftsperson
- Piping Draftsperson
- Electrical Draftsperson
- Geographic Information Systems
- Housing
- Construction

- 30.2 To identify personal skills and interests that may lead to a career exploration.

Ask each student to create an inventory of favorite activities and interests. Have students examine their lists to determine how these activities and interests might be job related. This task of creating an interest inventory may be done using a variety of computer program software packages. Once students have determined areas of interest related to drafting, they should research the career using available resources in the library, community or internet. (PSVS)

Learning Objectives**Notes**

- 30.3 To determine skills and interests that would enhance career choices.
(CCT)
- Using the list created, students may select two choices of possible careers for further research. Investigate the career choices including: the description of work duties; what personal qualities an individual must possess to succeed in the career; process to become certified within the career/trade; length of education and training; school locations; cost of education and up-grading; trends within the business or career; the best and worst parts of the job; beginning salary; and opportunities for advancement.
- If a work study will be done, the student may investigate career links within the community for possible work study placement. The student may interview the professional/tradesperson within the community as part of the career research.
- A class presentation may be done by students, if time permits.

Module 31: Reading Technical Documents (Blueprints) (Optional)

Suggested time: 2 - 5 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To understand the representation of three-dimensional objects presented on a two-dimensional plane.
- To appreciate the concept of scale and proportion.

Common Essential Learnings Foundational Objective

- To learn the basic principles of communication associated with reading technical documents. (COM)

Note: Other CELs may be used here.

	Learnings Objectives	Notes
31.1	To understand the use of blueprints/industrial prints.	Explain why the drawings are important, how they are used and types of information displayed on the prints.
31.2	To be able to identify the different types of drawings as they relate to each trade. (CCT)	Explain the different types of drawings relating to electrical, electronic, construction, cabinetry, automotives, machining, trades, etc.
31.3	To be able to identify the various types of views.	Show examples of orthographic, pictorial, sections, detailed and assembly drawings, etc. (COM)
31.4	To be able to identify the basic lines.	Show examples of object, hidden, center, dimension, extension, leader, cutting plane, break lines, and phantom lines. (COM)
31.5	To be able to understand the use for different notes and specifications.	Discuss notes and specifications as they apply to each trade.
31.6	To be able to identify information found on the drawing or in a title block.	Identify the bill of materials, name of parts, quantity required, order number, material, scale used, specifications, drawn by, drawing number, date, tolerances, company name, address, etc. (COM)
31.7	To be able to read dimensions from a drawing.	Identify the size and location of various features as they pertain to the type of drawing being examined.
31.8	To be able to identify general abbreviations and symbols.	Illustrate abbreviations and symbols as they apply to each trade. (COM)

Module 99: Extended Study (Optional)

Note: The extended study module may be used only once in a pure or survey course. It is important to record the title of the extended study module on the recordkeeping chart. Record 99A for the first extended study module offered in the course series, 99B for the second extended study module offered, etc.

Suggested time: 5 - 20 hours

Level: Introductory/Intermediate/Advanced

Module Overview

Evolving social and personal needs of society, advances in technology, and demands to solve current problems require a flexible curriculum that can accommodate new ways and means to support learning in the future. The extended study module is designed to provide schools with an opportunity to meet current and future demands that are not provided for in current modules in the renewed PAA curriculum.

The flexibility of this module allows a school/school division to design **one new module per credit to complement or extend the study of pure core and optional modules** configured to meet the specific needs of students or the community. The extended study module is designed to extend the content of the pure courses and to offer survey courses beyond the scope of the available selection of PAA modules from the pure courses.

The list of possibilities for topics of study or projects for the extended study module approach is as varied as the imagination of those involved in using the module. These optional extended study module guidelines should be used to strengthen the knowledge, skills, and processes advocated in the Practical and Applied Arts curriculum.

For more information on the guidelines for the Extended Study module see the *Practical and Applied Arts Handbook* (Draft 2000).

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Appendix A: Articulation

Articulation discussions have been initiated between Saskatchewan Education and Saskatchewan Institute of Applied Science and Technology (SIAST) for an agreement to articulate Practical and Applied Arts curricula with SIAST non-apprenticeable programs. Prior Learning Assessment (PLA) will be used to evaluate knowledge and skills of students.

Discussions are underway to articulate an agreement for the *Drafting and Computer-Aided Design Curriculum Guide* with courses offered at SIAST. Common course content between the K-12 curriculum guidelines and SIAST courses will be identified in order to establish articulation agreements. Details regarding these discussions have not been finalized at this time and will be released at a later date. More information on the Pathway for Articulation of the Non-apprenticeable Trades will be found in the *Practical and Applied Handbook* (Draft 2000).

Appendix B: Recordkeeping Charts

Drafting 10

Student Name: _____

Student Number: _____

Note: Module 1 or 2 should be chosen as core before progressing to other course modules.

Module Code	Module	Hours	Date	Teacher Initial
DRAF01	Module 1: Computer-Aided Drafting Basics* (C)			
DRAF02	Module 2: Basic Manual Drafting Tools and Procedures (C)			
DRAF03	Module 3: Sketching and Freehand Drawing Fundamentals (O)			
DRAF04	Module 4: Multi-view Drawings (C)			
DRAF05	Module 5: Pictorial Drawings (C)			
DRAF06	Module 6: Basic Dimensioning(C)			
DRAF07	Module 7: Sectional Views (C)			
DRAF08	Module 8: Basic 3D CAD* (O)			
DRAF30	Module 30: Career Opportunities (C)			
DRAF99	Module 99: Extended Study (O)			

* Computer access required

C – Core

O – Optional

Note: When the Extended Study, Work Study Preparation and Follow-up Activities, and Work Study modules are studied for the first time, record the module number and the letter A (Extended Study Module 99A). If the module is repeated at another level, the module is recorded using the letter B (Extended Study Module 99B).

It is recommended that this document be printed on school letterhead.

Drafting 20

Student Name: _____

Student Number: _____

Note: Module 1 or 2 should be chosen as core before progressing to other course modules.

Module Code	Module	Hours	Date	Teacher Initial
DRAF09	Module 9: Auxiliary Views and Revolutions (C)			
DRAF10	Module 10: Advanced Dimensioning (C)			
DRAF11	Module 11: Fasteners and Joints (O)			
DRAF12	Module 12: Working Drawings (C)			
DRAF13	Module 13: Floor Plans (O)			
DRAF14	Module 14: Foundation Plans (O)			
DRAF15	Module 15: Wall Sections (O)			
DRAF16	Module 16: Elevations (O)			
DRAF17	Module 17: Intermediate 3D CAD* (O)			
DRAF18	Module 18: Work Study Preparation and Follow-up Activities (O)			
DRAF19	Module 19: Work Study (O)			
DRAF99	Module 99: Extended Study (O)			

* Computer access required

C – Core

O – Optional

Note: When the Extended Study, Work Study Preparation and Follow-up Activities, and Work Study modules are studied for the first time, record the module number and the letter A (Extended Study Module 99A). If the module is repeated at another level, the module is recorded using the letter B (Extended Study Module 99B).

It is recommended that this document be printed on school letterhead.

Drafting 30

Student Name: _____

Student Number: _____

Note: Module 1 or 2 should be chosen as core before progressing to other course modules.

Module Code	Module	Hours	Date	Teacher Initial
DRAF18	Module 18: Work Study Preparation and Follow-up Activities (O)			
DRAF19	Module 19: Work Study (O)			
DRAF20	Module 20: Piping (O)			
DRAF21	Module 21: Pattern Development (O)			
DRAF22	Module 22: Mapping (O)			
DRAF23	Module 23: Electronics (O)			
DRAF24	Module 24: Residential Design (O)			
DRAF25	Module 25: Presentation Floor Plans (O)			
DRAF26	Module 26: Presentation Elevations (O)			
DRAF27	Module 27: Advanced 3D CAD* (O)			
DRAF28	Module 28: CAD/CAM* (O)			
DRAF29	Module 29: Surveying (O)			
DRAF30	Module 30: Career Opportunities (C)			
DRAF31	Module 31: Reading Technical Documents (Blueprints) (O)			
DRAF99	Module 99: Extended Study (O)			

* Computer access required

C – Core

O – Optional

Note: When the Extended Study, Work Study Preparation and Follow-up Activities, and Work Study modules are studied for the first time, record the module number and the letter A (Extended Study Module 99A). If the module is repeated at another level, the module is recorded using the letter B (Extended Study Module 99B).

It is recommended that this document be printed on school letterhead.