



Internet Applications and Web Development Advanced Program Standard

*The approved program standard for the
Internet Applications and Web Development
Advanced program of instruction leading to
an Ontario College Advanced Diploma
delivered by Ontario Colleges of Applied Arts
and Technology (MTCU funding code 60513)*

Ministry of Training, Colleges and Universities
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I. Introduction

This document is the Program Standard for the Internet Applications and Web Development Advanced program of instruction leading to an Ontario College Advanced Diploma delivered by Ontario colleges of applied arts and technology (MTCU funding code 60513).

Development of System-Wide Program Standards

In 1993, the Government of Ontario initiated program standards development with the objectives of bringing a greater degree of consistency to college programming offered across the province, broadening the focus of college programs to ensure graduates have the skills to be flexible and to continue to learn and adapt, and providing public accountability for the quality and relevance of college programs.

The Program Standards and Evaluation Unit of the Ministry of Training, Colleges and Universities has responsibility for the development, review, and approval of system-wide standards for programs of instruction at Ontario colleges of applied arts and technology.

Program Standards

Program standards apply to all similar programs of instruction offered by colleges across the province. Each program standard for a postsecondary program includes the following elements:

- **Vocational standard** (the vocationally specific learning outcomes which apply to the program of instruction in question),
- **Essential employability skills** (the essential employability skills learning outcomes which apply to all programs of instruction), and
- **General education requirement** (the requirement for general education in postsecondary programs of instruction).

Collectively, these elements outline the essential skills and knowledge that a student must reliably demonstrate in order to graduate from the program.

Individual colleges of applied arts and technology offering the program of instruction determine the specific program structure, delivery methods, and other curriculum matters to be used in assisting students to achieve the outcomes articulated in the standard. Individual colleges also determine whether additional local learning outcomes will be required to reflect specific local needs and/or interests.

The Expression of Program Standards as Vocational Learning Outcomes

Vocational learning outcomes represent culminating demonstrations of learning and achievement. They are not simply a listing of discrete skills, nor broad statements of knowledge and comprehension. In addition, vocational learning outcomes are interrelated and cannot be viewed in isolation of one another. As such, they should be viewed as a comprehensive whole. They describe performances that demonstrate that significant integrated learning by graduates of the program has been achieved and verified.

Expressing standards as vocational learning outcomes ensures consistency in the outcomes for program graduates, while leaving to the discretion of individual colleges curriculum matters such as the specific program structure and delivery methods.

The Presentation of the Vocational Learning Outcomes

The **vocational learning outcome** statements set out the culminating demonstration of learning and achievement that the student must reliably demonstrate before graduation.

The **elements of the performance statements** for each outcome define and clarify the level and quality of performance necessary to meet the requirements of the vocational learning outcome. However, it is the performance of the vocational learning outcome itself on which students are evaluated. The elements of performance are indicators of the means by which the student may proceed to satisfactory performance of the vocational learning outcome. The elements of performance do not stand alone but rather in reference to the vocational learning outcome of which they form a part.

The Development of a Program Standard

In establishing the standards development initiative, the Government determined that all postsecondary programs of instruction should include vocational skills coupled with a broader set of essential skills. This combination is considered critical to ensuring that college graduates have the skills required to be successful both upon graduation from the college program and throughout their working and personal lives.

A program standard is developed through a broad consultation process involving a range of stakeholders with a direct interest in the program area, including employers, professional associations, universities, secondary schools, and program graduates working in the field, in addition to students, faculty, and administrators at the colleges themselves. It represents a consensus of participating stakeholders on the essential learning that all program graduates should have achieved.

Updating the Program Standard

The Ministry of Training, Colleges and Universities will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Internet Applications and Web Development Advanced Program Standard remains appropriate and relevant to the needs of students and employers across the Province of Ontario. To confirm that this document is the most up-to-date release, contact the Ministry of Training, Colleges and Universities at the address or telephone number noted on the inside cover page.

II. Vocational Standard

All graduates of the Internet Applications and Web Development Advanced program of instruction must have achieved the 11 vocational learning outcomes listed in the following pages, in addition to achieving the essential employability skills learning outcomes and meeting the general education requirement.

Preamble

This program is designed to provide students with advanced knowledge, skills and experiences necessary to design, develop, and maintain internet, intranet and e-commerce applications. The student will also gain the entrepreneurial skills and knowledge necessary for small business functions. Part of this requirement is an advanced understanding of computer programming. Successful completion of the program results in the conferring of an Ontario College Advanced Diploma. The vocational learning outcomes articulate a range of advanced skills necessary for entry-level positions in internet application web developer, web programmer, e-commerce developer and web specialist.

The graduate performs a variety of complex tasks related to programming application development and design, visual design, project and time management, communications and administration of web server functions. The graduate can work independently and collaboratively with other information technology workers in a variety of environments including computer software development firms, graphic design agencies, information technology consulting firms and in information technology units in the private and public sectors, or they may be self-employed.

Synopsis of the Vocational Learning Outcomes Internet Applications and Web Development Advanced Program

The graduate has reliably demonstrated the ability to

- 1. relate effectively to web development supervisors, coworkers and clients.**
- 2. design internet services, and administer internet application servers and database servers.**
- 3. design, model, evaluate and administer effective databases, and interface with applications.**
- 4. develop policies to reinforce internet services and web application security, and contribute to the compliance to these policies.**
- 5. validate, debug and integrate client-side and server-side applications using a variety of development languages.**
- 6. design, develop and administer electronic commerce (e-commerce) applications.**
- 7. design, develop and administer effective websites by applying graphic and web design skills and principles.**
- 8. develop and administer websites reflective of business objectives and clients' needs through the application of advertising and marketing principles.**
- 9. adhere to relevant laws and industry standards.**
- 10. coordinate or participate as a member of a project management team that develops basic to complex internet applications.**
- 11. develop strategies for ongoing personal and professional development, that will lead to enhanced work performance and career opportunities, and keep pace with industry changes.**

Note: The vocational learning outcomes have been numbered as a point of reference; numbering does not imply prioritization, sequencing, nor weighting of significance.

The Vocational Learning Outcomes

1. *The graduate has reliably demonstrated the ability to*
relate effectively to web development supervisors, coworkers and clients.

Elements of the Performance

- communicate in written, graphic and oral forms to provide an appropriate degree of detail and accuracy;
- employ strategies for good client relations that build on respect and integrity;
- apply writing, speaking, and listening skills to develop and strengthen relationships within the field;
- identify and prioritize tasks assigned by supervisors and report on activities completed;
- summarize and communicate technical information for supervisors, coworkers, and clients;
- facilitate communications through the retrieval and interpretation of electronic documents.

2. *The graduate has reliably demonstrated the ability to*

design internet services, and administer internet application servers and database servers.

Elements of the Performance

- design and administer internet services, such as but not limited to Domain Name System (DNS), web servers, and file transfer and mail servers;
- apply troubleshooting techniques to verify the operation of internet services and servers;
- configure and administer application languages, such as but not limited to Hypertext Preprocessor (PHP), ASP.net and JavaServer Pages (JSP);
- configure and administer database servers and ensure their effective integration with web servers;
- combine knowledge of both software and programming languages to assist in research and development of new products and services;
- identify and establish best practices for internet services, application servers and database servers.

3. *The graduate has reliably demonstrated the ability to*

design, model, evaluate and administer effective databases, and interface with applications.

Elements of the Performance

- administer and evaluate the effectiveness of databases;
- design, model and implement user interfaces for databases that allow users to solicit, store, edit, and delete data, by using SQL (structured query language), DDL (data definition language), DML (data manipulation language) and DCL (data control language);
- address security and connectivity concerns, where applicable;
- ensure that operations related to the maintenance of a database are undertaken;
- analyze specifications for databases;
- apply advanced software principles to the development of effective database applications;
- identify and establish best practices for database development;
- manipulate a database with advanced queries and commands.

4. *The graduate has reliably demonstrated the ability to*

develop policies to reinforce internet services and web application security, and contribute to the compliance to these policies.

Elements of the Performance

- apply theory of encryption and Secure Sockets Layer (SSL) to monitor complex websites and their application security;
- resolve complex security problems;
- determine appropriate SSL applications;
- resolve cross-server security errors in new products and services through research and development;
- resolve application-specific attacks by developing appropriate defenses;
- perform a server lockdown audit;
- test web applications for vulnerabilities by applying knowledge of web-application security.

5. *The graduate has reliably demonstrated the ability to*

validate, debug and integrate client-side and server-side applications using a variety of development languages.

Elements of the Performance

- integrate external data and services into internet applications;
- apply advanced knowledge of object oriented programming and scalability to application development;
- validate the accessibility and effective functioning of applications;
- program and debug client-side and server-side applications;
- manage state data in a web application.

6. *The graduate has reliably demonstrated the ability to*

design, develop and administer electronic commerce (e-commerce) applications.

Elements of the Performance

- design and administer business processes applicable to e-commerce transactions;
- design and administer customer shopping cart software for electronic shopping;
- install third party software, real time credit and verification for electronic shopping;
- apply knowledge of third party credit card brokers and liability issues to the design of e-commerce applications.

7. *The graduate has reliably demonstrated the ability to*

design, develop and administer effective websites by applying graphic and web design skills and principles.

Elements of the Performance

- integrate several appropriate graphic and web applications to create complex website development projects;
- apply skills and principles of graphic design to create visually appealing websites;
- apply current principles of usability and accessibility to the website design;
- design navigational interfaces that function practically, and include within the website design;
- design visually appealing websites that are compliant with web standards;
- ensure that websites are compliant with web standards;
- apply visual design and principles of usability for a variety of website development projects;
- determine the use of appropriate graphics and web development applications for website design.

8. *The graduate has reliably demonstrated the ability to*

develop and administer websites reflective of business objectives and clients' needs through the application of advertising and marketing principles.

Elements of the Performance

- incorporate advertising and marketing requirements to enhance the economic productivity of websites;
- develop and administer websites reflective of and responsive to the needs of the clients' audience;
- develop and administer websites that are informed by business objectives;
- research and implement new features as requested by clients;
- undertake appropriate research when developing or adapting websites, e.g. Search Engine Marketing (SEM), site metrics;
- develop Search Engine Optimization (SEO) strategies for appropriate websites.

9. *The graduate has reliably demonstrated the ability to*
adhere to relevant laws and industry standards.

Elements of the Performance

- adhere to laws and regulations relevant to the collection and dissemination of information, e.g. Personal Information Protection and Electronic Documents Act (PIPEDA);
- apply knowledge of the codes of ethics and practice industry standards to one's daily activities;
- adhere to intellectual property legislation, including but not limited to copyright and trademark laws, as they pertain to web development;
- adhere to policies and procedures relevant to the collection and dissemination of information;
- adhere to fair dealing practices as they relate to website development;
- follow standard practices when purchasing a domain or becoming an Internet Service Provider (ISP).

10. *The graduate has reliably demonstrated the ability to*

coordinate or participate as a member of a project management team that develops basic to complex internet applications.

Elements of the Performance

- understand and apply project management concepts and strategies to the facilitation of a project management team, e.g. time management, budget constraints, scope of project;
- apply communication skills to support the effective functioning of the project management team;
- facilitate the development of an effective management project by providing appropriate information and perceptions;
- provide directions to others to assist with the effective completion of a web development project;
- take responsibility for one's job related performance, both as an individual and as a member of a team.

11. *The graduate has reliably demonstrated the ability to*

develop strategies for ongoing personal and professional development, that will lead to enhanced work performance and career opportunities, and keep pace with industry changes.

Elements of the Performance

- apply problem-solving and research skills for specific knowledge acquisition and skill development;
- identify training courses, workshops, and programs at appropriate institutions to enhance employment opportunities in the field of web development;
- engage in activities that include critical reflection and self-evaluation to promote professional competence;
- develop a plan that includes learning strategies and activities to improve one's skill level and to expand one's skill base;
- apply knowledge of associations in the web development field to one's work performance and career opportunities;
- use effective time management and organizational skills to accomplish personal and professional goals;
- review current and future trends in the web development field and apply to one's work;
- develop and maintain a portfolio of one's accomplishments in the web development field.

III. Essential Employability Skills

All graduates of the Internet Applications and Web Development Advanced program of instruction must have reliably demonstrated the essential employability skills learning outcomes listed on the following pages, in addition to achieving the vocational learning outcomes and meeting the general education requirement.

Context

Essential Employability Skills (EES) are skills that, regardless of a student's program or discipline, are critical for success in the workplace, in day-to-day living, and for lifelong learning.

The teaching and attainment of these EES for students in, and graduates from, Ontario's colleges of applied arts and technology are anchored in a set of three fundamental assumptions:

- these skills are important for every adult to function successfully in society today;
- our colleges are well equipped and well positioned to prepare graduates with these skills;
- these skills are equally valuable for all graduates, regardless of the level of their credential, whether they pursue a career path, or they pursue further education.

Skill Categories

To capture these skills, the following six categories define the essential areas where graduates must demonstrate skills and knowledge.

- Communication
- Numeracy
- Critical Thinking & Problem Solving
- Information Management
- Interpersonal
- Personal

Application and Implementation

In each of the six skill categories, there are a number of defining skills, or sub skills, identified to further articulate the requisite skills identified in the main skill categories. The following chart illustrates the relationship between the skill categories, the defining skills within the categories, and learning outcomes to be achieved by graduates from all postsecondary programs of instruction that lead to an Ontario College credential.

EES may be embedded in General Education or vocational courses, or developed through discrete courses. However these skills are developed, all graduates with Ontario College credentials must be able to reliably demonstrate the essential skills required in each of the six categories.

SKILL CATEGORY	DEFINING SKILLS: Skill areas to be demonstrated by graduates:	LEARNING OUTCOMES: The levels of achievement required by graduates. The graduate has reliably demonstrated the ability to:
COMMUNICATION	<ul style="list-style-type: none"> • Reading • Writing • Speaking • Listening • Presenting • Visual literacy 	<ol style="list-style-type: none"> 1. <i>communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.</i> 2. <i>respond to written, spoken, or visual messages in a manner that ensures effective communication.</i>
NUMERACY	<ul style="list-style-type: none"> • Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data • Conceptualizing 	<ol style="list-style-type: none"> 3. <i>execute mathematical operations accurately.</i>
CRITICAL THINKING & PROBLEM SOLVING	<ul style="list-style-type: none"> • Analyzing • Synthesizing • Evaluating • Decision making • Creative and innovative thinking 	<ol style="list-style-type: none"> 4. <i>apply a systematic approach to solve problems.</i> 5. <i>use a variety of thinking skills to anticipate and solve problems.</i>

SKILL CATEGORY	DEFINING SKILLS: Skill areas to be demonstrated by graduates:	LEARNING OUTCOMES: The levels of achievement required by graduates. The graduate has reliably demonstrated the ability to:
INFORMATION MANAGEMENT	<ul style="list-style-type: none"> • Gathering and managing information • Selecting and using appropriate tools and technology for a task or a project • Computer literacy • Internet skills 	<p>6. <i>locate, select, organize, and document information using appropriate technology and information systems.</i></p> <p>7. <i>analyze, evaluate, and apply relevant information from a variety of sources.</i></p>
INTERPERSONAL	<ul style="list-style-type: none"> • Team work • Relationship management • Conflict resolution • Leadership • Networking 	<p>8. <i>show respect for the diverse opinions, values, belief systems, and contributions of others.</i></p> <p>9. <i>interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.</i></p>
PERSONAL	<ul style="list-style-type: none"> • Managing self • Managing change and being flexible and adaptable • Engaging in reflective practices • Demonstrating personal responsibility 	<p>10. <i>manage the use of time and other resources to complete projects.</i></p> <p>11. <i>take responsibility for one's own actions, decisions, and consequences.</i></p>

IV. General Education Requirement

All graduates of the Internet Applications and Web Development Advanced program must have met the general education requirement described on the following pages, in addition to achieving the vocational and essential employability skills learning outcomes.

Requirement

The General Education Requirement for programs of instruction is stipulated in the Credentials Framework (Appendix A in the Minister's Binding Policy Directive *Framework for Programs of Instruction*).

In programs of instruction leading to either an Ontario College Diploma or an Ontario College Advanced Diploma, it is required that graduates have been engaged in learning that exposes them to at least one discipline outside their main field of study, and increases their awareness of the society and culture in which they live and work. This will typically be accomplished by students taking 3 to 5 courses (or the equivalent) designed discretely and separately from vocational learning opportunities.

This general education learning would normally be delivered using a combination of required and elective processes.

Purpose

The purpose of General Education in the Ontario college system is to contribute to the development of citizens who are conscious of the diversity, complexity, and richness of the human experience; who are able to establish meaning through this consciousness; and, who, as a result, are able to contribute thoughtfully, creatively, and positively to the society in which they live and work.

General Education strengthens student's essential employability skills, such as critical analysis, problem solving, and communication, in the context of an exploration of topics with broad-based personal and/or societal importance.

Themes

The themes listed below will be used to provide direction to colleges in the development and identification of courses that are designed to fulfil the General Education Requirement for programs of instructions.

Each theme provides a statement of Rationale and offers suggestions related to more specific topic areas that could be explored within each area. These suggestions are neither prescriptive nor exhaustive. They are included to provide guidance regarding the nature and scope of content that would be judged as meeting the intent and overall goals of General Education.

1. Arts in Society:

Rationale:

The capacity of a person to recognize and evaluate artistic and creative achievements is useful in many aspects of his/her life. Since artistic expression is a fundamentally human activity, which both reflects and anticipates developments in the larger culture, its study will enhance the student's cultural and self-awareness.

Content:

Courses in this area should provide students with an understanding of the importance of visual and creative arts in human affairs, of the artist's and writer's perceptions of the world and the means by which those perceptions are translated into the language of literature and artistic expression. They will also provide an appreciation of the aesthetic values used in examining works of art and possibly, a direct experience in expressing perceptions in an artistic medium.

2. Civic Life:

Rationale:

In order for individuals to live responsibly and to reach their potential as individuals and as citizens of society, they need to understand the patterns of human relationships that underlie the orderly interactions of a society's various structural units. Informed people will have knowledge of the meaning of civic life in relation to diverse communities at the local, national, and global level, and an awareness of international issues and the effects of these on Canada, and Canada's place in the international community.

Content:

Courses in this area should provide students with an understanding of the meaning of freedoms, rights, and participation in community and public life, in addition to a working knowledge of the structure and function of various levels of government (municipal, provincial, national) in Canada and/or in an international context. They may also provide an historical understanding of major political issues affecting relations between the various levels of government in Canada and their constituents.

3. Social and Cultural Understanding:

Rationale:

Knowledge of the patterns and precedents of the past provide the means for a person to gain an awareness of his or her place in contemporary culture and society. In addition to this awareness, students will acquire a sense of the main currents of their culture and that of other cultures over an extended period of time in order to link personal history to the broader study of culture.

Content:

Courses in this area are those that deal broadly with major social and cultural themes. These courses may also stress the nature and validity of historical evidence and the variety of historical interpretation of events. Courses will provide the students with a view and understanding of the impact of cultural, social, ethnic, or linguistic characteristics.

4. Personal Understanding:

Rationale:

Educated people are equipped for life-long understanding and development of themselves as integrated physiological and psychological entities. They are aware of the ideal need to be fully functioning persons: mentally, physically, emotionally, socially, spiritually, and vocationally.

Content:

Courses in this area will focus on understanding the individual: his or her evolution; situation; relationship with others; place in the environment and universe; achievements and problems; and his or her meaning and purpose. They will also allow students the opportunity to study institutionalized human social behaviour in a systematic way. Courses fulfilling this requirement may be oriented to the study of the individual within a variety of contexts.

5. Science and Technology:

Rationale:

Matter and energy are universal concepts in science, forming a basis for understanding the interactions that occur in living and non-living systems in our universe. Study in this area provides an understanding of the behaviour of matter that provides a foundation for further scientific study and the creation of broader understanding about natural phenomena.

Similarly, the various applications and developments in the area of technology have an increasing impact on all aspects of human endeavour and have numerous social, economic, and philosophical implications. For example, the operation of computers to process data at high speed has invoked an interaction between machines and the human mind that is unique in human history. This development and other technological developments have a powerful impact on how we deal with many of the complex questions in our society.

Content:

Courses in this area should stress scientific inquiry and deal with basic or fundamental questions of science rather than applied ones. They may be formulated from traditional basic courses in such areas of study as biology, chemistry, physics, astronomy, geology, or agriculture. As well, courses related to understanding the role and functions of computers (e.g., data management and information processing), and assorted computer-related technologies, should be offered in a non-applied manner to provide students with an opportunity to explore the impact of these concepts and practices on their lives.