



# **Web Development and Internet Applications Program Standard**

The approved program standard for Web Development and Internet Applications programs of instruction leading to an Ontario College Diploma delivered by Ontario Colleges of Applied Arts and Technology (MTCU funding code 50513).

Ministry of Colleges and Universities  
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# Introduction

This document is the Program Standard for the Web Development and Internet Applications programs of instruction leading to an Ontario College Diploma delivered by Ontario Colleges of Applied Arts and Technology (MTCU funding code 50513).

## 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 Unit of the Ministry of 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 from 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** 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 Colleges and Universities will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Web Development and Internet Applications 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, please contact the Ministry of Colleges and Universities:

[psu@ontario.ca](mailto:psu@ontario.ca)

# Vocational standard

All graduates of Web Development and Internet Applications programs have achieved the [ten vocational learning outcomes \(VLOs\)](#), in addition to achieving the essential employability outcomes and meeting the general education (GE) requirement.

## Preamble

Today's modern web development and internet applications professional requires expert technical knowledge to build web applications that are intuitive, inviting, accessible and attractive, while being with excellent communication, marketing, team, leadership and entrepreneurship skills.

In the Web Development and Internet Applications program you will become a professional developer (full-stack, web, database, etc.) using all of the latest web standards with the most advanced software used in the industry.

Ontario colleges of applied arts and technology offer the Web Development and Internet Applications program that prepares graduates for existing and emerging job opportunities. At the heart of the digital education provided to Ontario college students is the ability to be lifelong learners e.g. think critically, solve problems, and acquire new skills quickly. While these abilities are practised and enhanced in the context of a particular expertise, they are also transportable, with a reasonable training period, to other areas of expertise involving digital systems and their associated applications.

Graduates of the Web Development and Internet Applications program have acquired the knowledge and practical experience to support the continued extension of the application and ubiquitous nature of digital technology into our daily lives. As such, graduates can perform a variety of routine tasks related to internet applications. The graduate can work independently and collaboratively with other information technology workers in a variety of environments including computer software development firms, information technology consulting firms, graphic design agencies, and in information technology units in the private and public sectors. Within these environments, the graduate may find employment as a full-stack developer, internet systems administrator, internet site manager, internet site developer, internet web site technician, internet graphic designer, etc., or as a member of an integrated web development team.

While the vocational learning outcomes for programs, such as Web Development and Internet Applications, articulate the depth and breadth of skills, knowledge, and attitudes required by graduates when entering the work force, individual college programs may choose to build on this standard by offering some degree of specialization. Irrespective of the specialization, graduates' learning is significantly enhanced by opportunities for as much practical experience as is feasible during their time in the program.

There are many opportunities for graduates to pursue further educational qualifications. Graduates may be granted credits towards another program or degree or certificate, either through articulation agreements between the colleges and universities or by direct credit transfer. Students should contact individual colleges for further details of a college's articulation agreements or credit transfer possibilities.

To be successful in the digital environment requires an ongoing commitment from the graduate to continue to update their skills to stay current in this rapidly changing field. Making use of knowledge and experience gained during their studies, graduates may also choose to apply for professional designations from provincial, national, and international organizations as a further demonstration of their commitment to keep their skills current.

Note: The [Ontario Council on Articulation and Transfer](#) (ONCAT) maintains the provincial postsecondary credit transfer portal, [ONTransfer](#).



## Synopsis of the vocational learning outcomes

### Web Development and Internet Applications (Ontario College Diploma)

The graduate has reliably demonstrated the ability to:

1. Communicate and collaborate with team members and stakeholders to facilitate effective working relationships.
2. Configure, document and maintain fundamental server requirements for the effective functioning of applications.
3. Design, implement and maintain databases to store and retrieve data according to requirements.
4. Design and implement a security plan based on best practices, techniques and strategies to minimize risks of hacking and/or data loss.
5. Program and debug complex applications using a variety of development technologies and tools to optimize performance and minimize errors.
6. Create internet applications that apply design best practices, techniques and strategies for a variety of development projects that comply with accessibility, web and other requirements.
7. Develop internet applications reflective of business objectives and client needs.
8. Adhere to ethical, legal, and regulatory requirements and/or principles in the development and management of internet applications.
9. Participate as a member or leader of a team by applying project management concepts and strategies for the successful completion of a project.
10. Select and apply strategies for personal and professional development to enhance work performance.

Note: The 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: communicate and collaborate with team members and stakeholders to facilitate effective working relationships.

### **Elements of the performance**

- a. Identify strategies for communication success in academic, personal and career areas in order to develop and maintain effective working relationships.
- b. Facilitate communication and workflow among project team members including online chat, videoconferencing or collaborative document production.
- c. Use appropriate language, terminology and etiquette in both face-to-face and electronic communication with team members and stakeholders.
- d. Investigate, plan and create documents for web development and internet application requirements, by applying critical thinking skills.
- e. Create effective messages, both oral and written, that accurately reflect the audience and the purpose.
- f. Gather and analyze information from a variety of sources to assist in analyzing communication and business situations.
- g. Document sources using appropriate writing protocols for technical communication.
- h. Create effective reports, presentations and charts, to convey applicable project information to team members and stakeholders.
- i. Respond to team related conflicts by facilitating mediation exchanges that include empathy and situational awareness.

2. The graduate has reliably demonstrated the ability to: configure, document and maintain fundamental server requirements for the effective functioning of applications.

### **Elements of the performance**

- a. Configure, maintain and document internet services, such as but not limited to Domain Name System (DNS), web servers, and file transfer for the effective functioning of the server.
- b. Apply troubleshooting techniques to identify, resolve and document problems in the operation of network services and servers.
- c. Configure and maintain a variety of application languages for the effective functioning of applications.
- d. Configure, maintain and integrate database servers with web servers for the effective functioning of applications.
- e. Migrate and/or upgrade existing server set-up to a new location.
- f. Apply testing techniques to verify the operation of network services and servers.
- g. Install, configure and document applications for secure and confidential electronic transactions with third parties.

3. The graduate has reliably demonstrated the ability to: design, implement and maintain databases to store and retrieve data according to requirements.

### **Elements of the performance**

- a. Select and use appropriate tools and technologies to design, implement and maintain a database.
- b. Design, implement and maintain web user interfaces for databases that allow users to query, store, edit, and delete data.
- c. Manipulate a database with queries and commands, using **CRUD**\* operations.
- d. Address security and connectivity concerns, where applicable.
- e. Apply trouble shooting techniques by modifying existing scripts to resolve problems within databases.
- f. Recognize personal limits and seek assistance in a timely manner to resolve problems beyond one's own knowledge and skills.
- g. Plan the migration or conversion of data using industry techniques and standards, in order to interact with applications.
- h. Perform operations related to the maintenance of a database using industry techniques and standards.
- i. Apply data design principles to develop effective database applications, e.g. normalization.

[\\*See list of abbreviations](#)

4. The graduate has reliably demonstrated the ability to: design and implement a security plan based on best practices, techniques and strategies to minimize risks of hacking and/or data loss.

### **Elements of the performance**

- a. Secure access to a web application by applying principles of encryption.
- b. Apply rationale for a security certificate on a web server to enforce the secure transmissions and the confidentiality of data.
- c. Resolve specific security problems based on best practices, techniques and strategies.
- d. Monitor performance and server access to ensure security.
- e. Analyze log files to monitor security.
- f. Apply knowledge of server security to "lockdown" the server environment.
- g. Apply knowledge of secure web-application techniques in identifying common web-application vulnerabilities.
- h. Identify secure data transfer protocols to ensure data security and privacy.
- i. Minimize risk to clients when deploying computing system solutions by contributing to risk analysis.
- j. Assist in the identification of security risks, e.g. hacking and mitigation strategies.

5. The graduate has reliably demonstrated the ability to: program and debug complex applications using a variety of development technologies and tools to optimize performance and minimize errors.

### **Elements of the performance**

- a. Develop, troubleshoot, and process forms accurately and consistently.
- b. Develop, troubleshoot, and debug applications using a variety of development technologies and tools.
- c. Create, read, update and delete (**CRUD\***) data in the development of applications.
- d. Create user authentication and authorization functions for applications, when required.
- e. Program and debug applications using a variety of development and testing technologies and tools.
- f. Validate the accessibility and effective functioning of applications, including **WCAG\*** compliance.
- g. Manage state data in a web application.
- h. Document source code and follow best practices in its implementation.

[\\*See list of abbreviations](#)

6. The graduate has reliably demonstrated the ability to: create internet applications that apply design best practices, techniques and strategies for a variety of development projects that comply with accessibility, web and other requirements.

### **Elements of the performance**

- a. Create appropriate internet applications using graphics, fonts, and colours.
- b. Apply development environments for a variety of website development projects.
- c. Apply current skills and principles of graphic design to create internet applications.
- d. Apply current skills and principles of usability and accessibility to application development.
- e. Adapt navigational interfaces that function practically, and include them within internet applications.
- f. Create visually appealing internet applications that are compliant with web and other industry standards.
- g. Apply visual design and principles of usability for a variety of development projects.
- h. Create effective, accessible and efficient user interfaces for internet applications.
- i. Apply principles of accessibility to the development of internet applications.

7. The graduate has reliably demonstrated the ability to: develop internet applications reflective of business objectives and client needs.

### **Elements of the performance**

- a. Incorporate advertising and marketing best practices to enhance the business objectives of internet applications.
- b. Develop and maintain internet applications reflective of and responsive to the needs of the client.
- c. Develop internet applications that are informed by business objectives.
- d. Research and implement new features as requested by clients.
- e. Undertake appropriate research when developing or adapting or modernizing internet applications e.g. Search Engine Marketing (SEM), analytics.
- f. Implement and optimize Search Engine Optimization (SEO) strategies for internet applications.
- g. Create a test plan for the development and verification of an application.
- h. Apply use cases for validation of application of client needs.



8. The graduate has reliably demonstrated the ability to: adhere to ethical, legal, and regulatory requirements and/or principles in the development and management of internet applications.

### **Elements of the performance**

- a. Adhere to national and international laws and regulations relevant to the collection and dissemination of information; e.g. **PIPEDA\***, **GDPR\***, **WCAG\***, **CCPA\***.
- b. Apply codes of ethics and practice industry standards to one's daily activities.
- c. Adhere to intellectual property legislation, and recommend copyright best practice and trademark laws, as they pertain to internet development.
- d. Adhere to policies and procedures relevant to the collection and dissemination of personal data.
- e. Adhere to fair dealing practices as they relate to internet application development.
- f. Apply accepted socially responsible principles for use of social media and other data.

[\\*See list of abbreviations](#)

9. The graduate has reliably demonstrated the ability to: participate as a member or leader of a project team by applying project management concepts and strategies for the successful completion a project.

### **Elements of the performance**

- a. Interpret and apply project management concepts and strategies during the participation in or facilitation of a project management team; e.g., time management, budget constraints, scope of project, cost estimations.
- b. Apply communication skills to support the effective functioning of the project management team.
- c. Participate in and facilitate the development of an effective project by providing appropriate information and perceptions.
- d. Act upon and/or provide directions to others to assist with the effective completion of an internet application project.
- e. Take responsibility for one's job related performance, both as an individual and as a member of a team.
- f. Use industry standard project management methodologies and tools effectively with team members.

10. The graduate has reliably demonstrated the ability to: select and apply strategies for personal and professional development to enhance work performance.

### **Elements of the performance**

- a. Apply problem-solving and research skills for specific knowledge acquisition and skill development.
- b. Identify training courses, workshops, and programs at appropriate institutions to enhance employment opportunities in the field of internet application development.
- c. Engage in activities that include critical reflection and self-evaluation to promote professional competence.
- d. Develop a plan that includes learning strategies and activities to improve one's skill level and to expand one's skill base.
- e. Apply knowledge of associations in the internet application development field to one's work performance and career opportunities.
- f. Use effective time-management and organizational skills to accomplish personal and professional goals.
- g. Remain current with relevant technological change that could have an impact on internet application development.
- h. Develop and maintain a portfolio of one's accomplishments in the internet application development field.
- i. Provide support and feedback to peers using online sharing and communication tools.

# List of abbreviations

**CCPA:** California Consumer Privacy Act.

**CRUD:** Create, Read, Update, and Delete.

**GDPR:** General Data Protection Regulation.

**PIPEDA:** Personal Information Protection and Electronic Documents Act.

**WCAG:** Web Content Accessibility Guidelines.

# Essential employability skills

All graduates of the Web Development and Internet Applications program of instruction must have reliably demonstrated the essential employability skills learning outcomes listed below, 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.

<b>Skill category</b>	<b>Defining skills:</b> Skill areas to be demonstrated by graduates:	<b>Learning outcomes:</b> The levels of achievement required by graduates.  The graduate has reliably demonstrated the ability to:
Communication	<ul style="list-style-type: none"> <li>• Reading</li> <li>• Writing</li> <li>• Speaking</li> <li>• Listening</li> <li>• Presenting</li> <li>• Visual literacy</li> </ul>	<ol style="list-style-type: none"> <li>1. communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience.</li> <li>2. respond to written, spoken or visual messages in a manner that ensures effective communication.</li> </ol>
Numeracy	<ul style="list-style-type: none"> <li>• Understanding and applying mathematical concepts and reasoning</li> <li>• Analyzing and using numerical data</li> <li>• Conceptualizing</li> </ul>	<ol style="list-style-type: none"> <li>1. execute mathematical operations accurately.</li> </ol>
Critical Thinking & Problem Solving	<ul style="list-style-type: none"> <li>• Analyzing</li> <li>• Synthesizing</li> <li>• Evaluating</li> <li>• Decision making</li> <li>• Creative and innovative thinking</li> </ul>	<ol style="list-style-type: none"> <li>1. apply a systematic approach to solve problems.</li> <li>2. use a variety of thinking skills to anticipate and solve problems.</li> </ol>

<p>Information Management</p>	<ul style="list-style-type: none"> <li>• Gathering and managing information</li> <li>• Selecting and using appropriate tools and technology for a task or a project</li> <li>• Computer literacy</li> <li>• Internet skills</li> </ul>	<ol style="list-style-type: none"> <li>1. locate, select, organize and document information using appropriate technology and information systems.</li> <li>2. analyze, evaluate and apply relevant information from a variety of sources.</li> </ol>
<p>Interpersonal</p>	<ul style="list-style-type: none"> <li>• Teamwork</li> <li>• Relationship management</li> <li>• Conflict resolution</li> <li>• Leadership</li> <li>• Networking</li> </ul>	<ol style="list-style-type: none"> <li>1. show respect for the diverse opinions, values, belief systems and contributions of others.</li> <li>2. interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.</li> </ol>
<p>Personal</p>	<ul style="list-style-type: none"> <li>• Managing self</li> <li>• Managing change and being flexible and adaptable</li> <li>• Engaging in reflective practices</li> <li>• Demonstrating personal responsibility</li> </ul>	<ol style="list-style-type: none"> <li>1. manage the use of time and other resources to complete projects.</li> <li>2. take responsibility for one's own actions, decisions and their consequences.</li> </ol>

# General education requirement

All graduates of the Web Development and Internet Applications program must have met the [general education requirement](#) described below, 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 students' 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 Ontario 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.

### **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.

### **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, as well as 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 a Canadian 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.

### **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.

### **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.

### **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 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.

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