Web Development Program Standard

The approved program standard for Web Development programs of instruction leading to an Ontario College Graduate Certificate delivered by Ontario Colleges of Applied Arts and Technology (MTCU funding code 70516).

Acknowledgements

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- Bill Fallis, the Project Officer who led the development of the English vocational learning outcomes.

Contents:

Introduction

This document is the Program Standard for the Web Development programs of instruction leading to an Ontario College Graduate Certificate delivered by Ontario Colleges of Applied Arts and Technology (MTCU funding code 70516).

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 element:

- **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 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:

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Vocational standard

All graduates of Web Development programs have achieved the [twelve vocational learning outcomes (VLOs)](#) in the following pages.

Preamble

Increasingly, individuals and organizations look to internet applications to optimize workflow, establish a presence in global markets, and improve communication. This pervasive integration of internet applications and their associated technologies has led to an emergence of job opportunities in the creation, integration, and support of digital systems and infrastructures. This program is designed to provide students with the knowledge and practice required to function within the web development field.

Ontario colleges of applied arts and technology offer the web development program that prepares graduates for both existing and emerging opportunities in our society. At the heart of the digital education provided to Ontario college students is the ability to 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 Web Development programs 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 are able to perform a variety of tasks related to websites, and web applications, and requires an understanding of basic programming principles, internet applications, visual design, and communications.

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 an internet site developer, internet site designer, internet graphic designer, etc., or as a member of an integrated web development team. Graduates may also find themselves working as their own agent for web-based solutions or websites representative of local or international businesses.

While the vocational learning outcomes for programs, such as Web Development, 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 (Ontario College Graduate Certificate)

The graduate has reliably demonstrated the ability to:

1. Determine and document requirements for web computing projects based on the effective application of stakeholder needs.

2. Prepare and present proposals and business plans for web applications that satisfy stakeholder requirements.

3. Design, model, implement and optimize **accessible*** web solutions to meet client requirements and constraints, and align with standards and best practices.

4. Design, model, implement, optimize and maintain databases to support data-driven solutions for web environments.

5. Implement a development process to support consistency between development platforms and production platforms.

6. Develop the appropriate information architecture in order to satisfy a broad range of requirements and enhance the user experience.

7. Apply project management concepts to web environment projects to ensure effective working relationships

8. Test, troubleshoot and debug web applications to support requirements and meet Quality Assurance objectives.

9. Communicate and collaborate with team members and stakeholders to ensure effective working relationships.

10. Evaluate proposed solutions to optimize and improve web application based on usability testing and analysis.

11. Adhere to ethical, legal, and regulatory requirements and/or principles to develop and manage web applications.

12. 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: determine and document requirements for web computing projects based on the effective application of stakeholder needs.

Elements of the performance

a. Use tools to gather required information to support design and development proposals.
b. Produce documentation of hardware/software design using industry standard tools.
c. Use appropriate techniques to determine the requirements to complete computing tasks.
d. Prepare, present, and maintain current, clear, and accurate documentation.
e. Analyze business cases and gathered information to generate project requirements, based on stakeholder requirements.

2. The graduate has reliably demonstrated the ability to: prepare and present proposals and business plans for web applications that satisfy stakeholder requirements.

Elements of the performance

a. Research and analyze current and emerging technologies in order to prepare proposals that meet business needs.
b. Present current and emerging technologies to a variety of stakeholders.
c. Relate applications of current and emerging technologies to existing business and technical problems.
d. Defend the case for the adoption of emerging technologies within an established web applications environment.
e. Research and present the business rationale and return on investment for the proposal.
f. Review business risk factors before applying new technologies to a proposal or business plan.

3. The graduate has reliably demonstrated the ability to: design, model, implement and optimize **accessible*** web solutions to meet client requirements and constraints, and align with standards and best practices.

Elements of the performance

a. Apply a variety of analysis, design, and development concepts and methodologies to activities throughout the life cycle of web applications.
b. Evaluate the design conditions for the implementation and configuration of a solution.
c. Design, develop, and test web systems for security against various threats.
d. Adhere to and advocate for ethical principles and standards in the development of web solutions.
e. Research and apply guidelines from various technology sources that prescribe quality programs, practices, processes, and procedures.
f. Select and apply appropriate methodologies for the analysis and design phases of application development.
g. Design, develop, document, and deploy applications based on specifications and in compliance with industry and governmental regulations and best practices, including accessibility.

4. The graduate has reliably demonstrated the ability to: design, model, implement, optimize and maintain databases to support data-driven solutions for web environments.

Elements of the performance

a. Evaluate the ethical implications of information and data handling within web solutions and systems.
b. Discuss the ethical issues related to current and emerging technologies, such as Artificial Intelligence, data ownership, data privacy, etc.
c. Use various methods to create, update, filter, sort, validate and manage data storages.
d. Create **SQL***, **DML*** and **DDL*** statements for data retrieval and definition.
e. Design and maintain relational and non-relational databases following best practices.
f. Prepare data storage design reports which meet clients' needs.
g. Apply higher normal forms to eliminate more obscure data redundancies in a database.
h. Propose, justify, design and develop integrated data storage solutions based on the analysis of business environment conditions.
i. Design, test, document, and deploy data-driven application programs based on client requirements.
j. Adhere to confidentiality and privacy regulations in the collection, storage and distribution of personal information, including **FIPPA*** and other pertinent regulatory frameworks and/or compliancy requirements.

[*See list of abbreviations](#)

5.   The graduate has reliably demonstrated the ability to: implement a development process to support consistency between development platforms and production platforms.

Elements of the performance

a.   Assess the impacts of the environment (e.g. hardware, software, operating system) on the installation and customization of web applications.
b.   Select appropriate methodologies to support consistency of application development process.
c.   Research appropriate testing and deployment approaches for web applications.
d.   Compare application deployment processes on a variety of platforms to select appropriate deployment targets.

6. The graduate has reliably demonstrated the ability to: develop the appropriate information architecture in order to satisfy a broad range of requirements and enhance the user experience.

Elements of the performance

a. Analyze, design, develop, and maintain effective user interfaces.
b. Evaluate security impact and potential vulnerabilities of various information architecture solutions for the protection of web applications.
c. Evaluate **UX*** on the architecture chosen for a specific web solution.
d. Select and use appropriate design architectures for the chosen web application development process.
e. Select and use appropriate design architectures to support consistency of user experience.
f. Research and evaluate the intended audience for a particular information architecture.

[*See list of abbreviations](#)

7. The graduate has reliably demonstrated the ability to: apply project management concepts to web environment projects to ensure effective working relationships.

Elements of the performance

a. Participate in the planning, identification, scheduling, and assigning of tasks and resources involved in a project as required.
b. Monitor resources and expenditures to maintain cost effectiveness and timelines of a project.
c. Consolidate project updates at regular intervals.
d. Estimate accurately the time and cost required to complete project elements.
e. Complete project elements according to schedule.
f. Interpret and use relevant project planning documents and tools.
g. Identify problems that will affect the project timeline, and recommend changes, as soon as possible.
h. Maintain current, clear, and accurate project-related documents which adhere to organizational and industry standards and procedures.
i. Manage and control the changing requirements throughout the life cycle of a project.
j. Select the proper project management techniques to develop the project, e.g. scrum.

8. The graduate has reliably demonstrated the ability to: test, troubleshoot and debug web applications to support requirements and meet Quality Assurance objectives.

Elements of the performance

a. Formulate troubleshooting procedures taking into account the problem and the environment.
b. Monitor, review, and assess the effectiveness of the troubleshooting procedure.
c. Document the troubleshooting procedure clearly.
d. Establish and follow troubleshooting procedures, and explain them clearly to others.
e. Create recovery plans and test concepts.
f. Apply a variety of techniques to test and debug web solutions.
g. Select appropriate testing methodologies based on specifications, and document results of tests.
h. Contribute to risk analysis to minimize risks to clients when deploying web solutions.
i. Prepare, complete and supervise systems tests.
j. Develop and deploy test plans to verify that requirements are met.
k. Select and apply appropriate version control and debugging methods to maintain program integrity.

9. The graduate has reliably demonstrated the ability to: communicate and collaborate with team members and stakeholders to ensure effective working relationships.

Elements of the performance

a. Gather well defined system requirements by effectively communicating with stakeholders.
b. Maintain professional and honest relationships with stakeholders.
c. Identify strategies for communication success in academic, personal and career areas in order to develop and maintain effective working relationships.
d. Facilitate communication and workflow among project team members including online chat, video-conferencing or collaborative document production.
e. Use appropriate language, terminology and etiquette in both face to-face and electronic communication with team members and stakeholders.
f. Investigate, plan and create documents for web requirements, by applying critical thinking skills.
g. Create effective messages, both oral and written, that accurately reflect the audience and the purpose.
h. Document sources using appropriate writing protocols for technical communication.
i. Create effective reports, presentations and charts, to convey applicable project information to team members and stakeholders.
j. Use collaborative tools specific to web solution development.
k. Apply and foster best practices for project control with respect to business principles, such as teamwork, scheduling and communications.
l. Comply with legislative and workplace policies, and, if applicable, suggest appropriate changes.
m. Communicate with team members to reflect on project actuals in order to improve workflow, sustainability, and efficiencies.

10. The graduate has reliably demonstrated the ability to: evaluate proposed solutions to optimize and improve web applications based on usability testing and analysis.

Elements of the performance

a. Analyze patterns and trends in usage to identify potential opportunities for improvement.
b. Identify appropriate feedback metrics to determine potential trends.
c. Use appropriate tools to collect feedback and analyse feedback metrics.
d. Conduct feedback analysis for emerging issues and trends to support solution development.
e. Report the results of usage, feedback and usability tests accurately to a variety of stakeholders.

11. The graduate has reliably demonstrated the ability to: adhere to ethical, legal, and regulatory requirements and/or principles to develop and manage web applications.

Elements of the performance

a. Adhere to laws, regulations and standards relevant to the collection and dissemination of information; e.g. **PIPEDA***, **GDPR***, **WCAG***.
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](#)

12. 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 web computing environment.
c. Engage in activities that include self-directed learning, 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 web computing environment 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 the web computing environment.
h. Develop and maintain a portfolio of one's accomplishments in the web computing environment.
i. Provide mutual support and feedback to peers using online sharing and communication tools.

List of abbreviations

Accessible: perceivable, operable, and understandable for people with a wide range of abilities.

DDL: Data Definition Language.

DML: Data Manipulation Language.

FIPPA: Freedom of Information and Protection of Privacy Act.

GDPR: General Data Protection Regulation.

PIPEDA: Personal Information Protection and Electronic Documents Act.

SQL: Structured Query Language.

UX: User Experience.

WCAG: Web Content Accessibility Guidelines.

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