ENVIRONICS RESEARCH GROUP

FINAL
REPORT

Needs of Canadian Science Educators for Science and Technology Information: A Qualitative Exploration

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1.0 EXECUTIVE SUMMARY

In their day-to-day professional life, science and technology educators find that teaching often takes a secondary place to such activities as planning and developing lesson plans; preparing classroom activities, exams and assignments; setting up labs and workshops; marking assignments, exams and labs and performing administrative duties.

One important and on-going aspect of science educators' professional responsibilities involves keeping current with both the state of knowledge in the subjects they teach and with curriculum changes. They look for materials and information they can use to encourage interest and enthusiasm in their students and offer reinforcement of the basic curriculum in ways that support the diverse learning styles of their students. They are also interested in locating activities, lesson plans, assignments, and other ready-to-go materials that are of high quality, match their curriculum requirements, and have the potential of either giving them new ideas or saving them time.

Science and technology educators rely heavily on recommendations from other teachers who cover similar content in their own classes to locate useful resources. They also find information on resources through conferences, seminars, and professional listservs or Internet discussion forums. Educators access a wide variety of information resources: books, magazines, journals, science programs on television and radio, and the Internet.

The Internet is a primary source of information for some, particularly those who have identified particular websites that are of use to them. Others use the Internet to find specific information on a topic that has come to their attention through another source. Regardless of how it is used, the Internet is considered a valuable source by many educators. However, because of time constraints, some find searching for information on the Internet unnecessarily time consuming.

Information sources and resources that will cut down on the time spent on any of their regular responsibilities without causing a reduction in quality would seem to be well accepted. On the other hand, anything that is perceived as taking more of their time would not be welcome.

Computers and the Internet in Teaching

Access to computer technology and the Internet in the library, the lab and the classroom is becoming increasingly common, and the use of computer-based resources in preparation and

planning, teaching and administration is growing. Teachers in Montreal noted that the curriculum in Quebec is being redesigned, and all courses will require computer use.

Some teachers access the Internet regularly, even daily, in order to keep up with information that might be useful in their classes. Some use the Internet heavily in lesson preparation because there are no suitable textbooks available, or because they prefer to put together their own instructional materials from Web sources. Many use Internet-based resources as visual aids to illustrate or complement their lectures.

Key characteristics of websites considered good resources include:
- Good presentation, with multimedia, good and interesting visuals and animations.
- Well organized so that material is easy to find.
- Professional and credible information.
- Well designed, easy to use, free of technical problems, difficulties with loading pages, etc.
- Appropriate level of difficulty, with materials that are identified for different age/grade levels.
- Interactivity.
- Teacher's resource sites that offer well-designed evaluation materials (worksheets with answer keys, etc).

Characteristics that make a website a poor one:
- Too "wordy" or text-heavy, lacking in visuals and animations.
- Ads and pop-ups.
- Poor organisation and design, difficult navigation.
- Too technical, above the level of their students.
- Lack of proper attribution, poor credibility.

Some of the most frequently mentioned reasons for using websites included:
- Availability of interesting activities for students.
- Good use of animations and visual elements.
- Informative and well-written articles.
- New and interesting research or scientific facts.
- Lesson plans and presentation tools for teachers.
- Collections of useful links.
- Materials that are curriculum-appropriate.

When looking for information to use in their teaching, most teachers begin with a search engine, usually Google, although some use a variety of different search engines. A few, including librarians, also use specialised databases as well as search engines to gather information.

The issue of credibility is very important to science and technology teachers in selecting Internet resources. Many only go to websites run by organizations they trust – universities, professional journals, provincial and federal government sites.

Canadian Content and Use of Government of Canada Sites

Canadian content and Canadian resources are of importance to some teachers. Others do not feel that links between subject matter and Canadian research or experience are important. Some select the resource materials they use primarily on the basis of their quality and not on their specific relevance to Canada.

A number of teachers regularly use Government of Canada websites for information. Others do not find Government of Canada websites useful, referring to them as too text-heavy and difficult to search.

Awareness and previous use of the Science.gc.ca website was quite limited; only a few participants had visited the website before. Those who were aware of the site had found it either as a result of an Internet search or because they had heard about it, either through colleagues or through promotional materials.

Among those who had visited the website before, perceptions of the site were mixed. A few thought it was a potentially useful site and had used some of the resources available on the site, but others found it difficult to locate the information or kinds of teaching resources they wanted and had not returned to it.

Exploring Science.gc.ca

Initial positive responses to Science .gc.ca focused on extensive information, ease of navigation and good organization. Those who liked the website expected that they would be able to easily locate credible information on a wide range of subjects. Some found visuals during their initial search that they felt they could use with their students and this heightened their appreciation of the site.

However, a number of participants found the Science.gc.ca website to be visually uninspiring. It did not draw them in, and they were concerned that the presentation of the site would not appeal to students, who are accustomed to slick presentation values and a heavy use of graphic elements.

A number of participants felt overwhelmed by the extensive information available on and through the website. Some were concerned when they could not find enough information on their specialties; others felt that the site was too focused on science and not sufficiently informative on technology studies, and felt frustrated by the difficulty they encountered. Some thought that the information was too advanced and too technical for themselves, let alone their students. Others found the information to be too basic in tone.

Many were unsure of the intended audience for the Science.gc.ca website – teachers, students, or the general public. They felt that, if the material – or some of it – was intended for students, the level should be clearly indicated in a way that was relevant to all provincial curriculum requirements, so that teachers would not have to guess if the information was appropriate to the age or grade of their students. Without any cues as to the level of difficulty and complexity of any specific items, it was difficult for some to determine whether the information on the website was appropriate to the audience they had in mind.

Some felt that the information needed to be more layered, as well as more interactive and visual, using hypertexting to introduce not only more complex information on a given concept, but also to bring in visual or multimedia elements that would engage students more fully.

Key to successful organization of information for participants was the ability to be able to quickly identify and locate the specific information that would be of use to them. Participants wanted access to assessment tools, lesson plans, assignments and activities, and lab projects, available as fully developed packages. They also wanted to have access to visual elements and animations that they could use in class to engage their students, or that they could refer their students to for more information delivered in a way that would hold their interest.

Some participants were unfamiliar with the term "portal." In general, the response to the idea of using a portal site was mixed. Some noted with interest the wide range of material available through the Science.gc.ca portal. Others seemed somewhat neutral, and others did not appreciate the approach.

The Science.gc.ca Teacher's Kit

Most teachers welcome classroom resource kits from all sources – governments, corporations, publishing companies.

Many participants were interested in the Science.gc.ca teacher's kit and thought it could potentially be of use to them, that if these materials were good, they might look for similar materials or other resources on the Science.gc.ca website. The key interest was in having access to good quality, curriculum-appropriate visual resources for their students, and preparation tools for themselves.

The CDs of online resources and lesson plans and the DVD of collected videos received the most interest from participants. Some were also interested in finding out what kind of websites the Science Voyager CD would take them to. A number of participants also expressed interest in the population map. The teaching topics poster received mixed responses.

Increasing Awareness of S&T Resources

Suggestions for increasing the awareness of S&T resources such as the Science.gc.ca website included: spreading awareness by word of mouth; presentations at conferences and seminars; presentations to Ministries of Education, Boards of Education, departments of science within schools, and professional organizations for science and technology teachers; advertising in professional journals; making information about the resources available to Faculties of Education; and placing promotional materials in school and public libraries.

2.0 RÉSUMÉ DU RAPPORT

Dans le cadre de leur vie professionnelle, les enseignants de sciences et de technologie s'aperçoivent que l'enseignement proprement dit vient souvent au second rang derrière des activités telles que la planification et l'élaboration des plans de cours; la préparation des activités de salle de cours, les examens et les devoirs, la préparation des laboratoires et des ateliers, la correction des devoirs, des examens et des rapports de laboratoire, ainsi que diverses tâches administratives.

Un aspect important et continu des responsabilités professionnelles des enseignants de sciences consiste à maintenir à jour leurs connaissances, tant au sujet des disciplines qu'ils enseignent qu'au sujet des changements apportés au programme. Ils recherchent des documents et de l'information qu'ils peuvent utiliser afin de stimuler l'intérêt et l'enthousiasme de leurs étudiants et, ainsi, renforcer le programme de base de manière à soutenir les différents modes d'apprentissage de leurs étudiants. Ils sont également intéressés à trouver des activités, des plans de cours, des devoirs et d'autres documents prêts à utiliser qui sont de grande qualité, correspondent aux exigences de leurs programmes d'enseignement et qui peuvent, soit leur apporter de nouvelles idées ou leur faire gagner du temps.

Les enseignants de sciences et de technologie se fient beaucoup aux recommandations provenant d'autres pédagogues qui enseignent des contenus semblables, afin de repérer des ressources utiles. Ils obtiennent également de l'information sur ces ressources par le truchement de conférences, de séminaires, ainsi que par des *listservs* professionnels ou des forums de discussion sur l'Internet. Les enseignants ont accès à une vaste gamme de ressources d'information : livres, magazines, revues spécialisées, émissions scientifiques à la télévision et à la radio, ainsi que l'Internet.

L'Internet est une source d'information de premier plan pour certains, en particulier ceux qui ont identifié des sites Web qui leur sont précisément utiles. D'autres utilisent l'Internet pour trouver des renseignements précis sur un sujet qui a été porté à leur attention par le truchement d'une autre source. Peu importe de quelle façon ils l'utilisent, un grand nombre d'enseignants jugent que l'Internet est une bonne source d'information. Cependant, en raison de contraintes de temps, certains jugent que la recherche d'information sur l'Internet gruge beaucoup de temps sans raison.

Il semble que des sources d'information et des ressources qui réduiront le temps consacré à une ou l'autre de leurs responsabilités habituelles sans entraîner une baisse de la qualité de leur enseignement, seraient bien accueillies. Par contre, on ne peut pas dire la même chose de tout ce qu'on perçoit comme exigeant plus de temps.

Les ordinateurs et l'Internet dans l'enseignement

L'accès aux ordinateurs et à l'Internet à la bibliothèque, au laboratoire et dans la salle de classe devient de plus en plus répandu, et l'utilisation de ressources informatiques va croissant dans la préparation et la planification, l'enseignement et la gestion. Les enseignants de Montréal ont noté que le programme québécois est en voie de refonte et que tous les cours nécessiteront l'utilisation d'un ordinateur.

Certains enseignants utilisent régulièrement l'Internet, voire chaque jour, afin de se maintenir à jour sur l'information pouvant s'avérer utile dans leurs cours. Certains utilisent beaucoup l'Internet dans la préparation de cours parce qu'il n'existe pas de manuels adéquats qui soient disponibles ou parce qu'ils préfèrent assembler leurs propres documents pédagogiques à partir de sources provenant de l'Internet. Un grand nombre d'enseignants utilisent des ressources accessibles sur l'Internet à titre d'aides visuelles pour illustrer ou compléter leurs cours.

Les caractéristiques clés des sites Web considérés être de bonnes ressources comprennent :
- Offrir une bonne présentation, le recours au multimédia, des composantes visuelles et des animations de qualité et intéressantes.
- Être bien structuré de sorte qu'il est facile de trouver l'information.
- Offrir une information à la fois professionnelle et crédible.
- Posséder une bonne conception, être facile à utiliser, ne pas présenter de problèmes techniques ou de difficulté dans le téléchargement des pages, etc.
- Être d'un niveau de difficulté adéquat et offrir des documents qui sont identifiés selon l'âge/le niveau scolaire.
- Être interactif.
- Des sites de ressources pour les enseignants qui offrent des documents d'évaluation bien étoffés (feuilles de travail avec des clés de réponses, etc.).

Les caractéristiques qui font de sorte qu'un site Web soit jugé d'une piètre utilité :
- Afficher trop de texte et présenter des lacunes au titre des composantes visuelles et des animations.
- Publicités et fenêtres contextuelles.
- Organisation et conception médiocres, difficultés de navigation.
- Trop technique ou dépassant le niveau de connaissances des étudiants.
- Absence d'attributions appropriées, manque de crédibilité.

Certaines des raisons mentionnées le plus fréquemment pour justifier l'utilisation de sites Web comprenaient :
- Disponibilité d'activités intéressantes pour les étudiants.

- Bonne utilisation des animations et des composantes visuelles.
- Des articles instructifs et bien rédigés.
- Des recherches scientifiques ou des faits nouveaux et intéressants.
- Des plans de cours et des outils de présentation à l'intention des enseignants.
- Collection de liens utiles.
- Des documents qui correspondent au programme.

Lorsqu'ils cherchent de l'information qu'ils veulent utiliser dans le cadre de leur enseignement, la plupart des enseignants débutent leur recherche à l'aide d'un moteur de recherche, habituellement Google, bien que certains utilisent une gamme d'autre moteurs de recherche. Quelques uns, y compris les bibliothécaires, utilisent également des bases de données spécialisées et des moteurs de recherche pour recueillir de l'information.

La question de crédibilité est très importante aux yeux des enseignants de sciences et de technologie dans le choix de ressources sur l'Internet. Un grand nombre d'entre eux ne visitent que les sites Web d'organismes auxquels ils font confiance – sites des universités, de revues professionnelles, ainsi que les sites des gouvernements provinciaux et fédéral.

Le contenu canadien et l'utilisation des sites du gouvernement du Canada

Un contenu canadien et des ressources canadiennes ont de l'importance aux yeux de certains enseignants. D'autres ne pensent pas qu'il soit important d'établir de lien entre un sujet donné et la recherche ou l'expérience canadienne. Certains choisissent les documents d'information qu'ils utilisent surtout en fonction de leur qualité et non pas en fonction de leur pertinence pour le Canada en particulier.

Bon nombre d'enseignants utilisent régulièrement des sites du gouvernement du Canada pour obtenir de l'information. D'autres jugent que les sites du gouvernement du Canada ne sont pas utiles, les décrivant comme présentant trop de texte et jugeant qu'il est trop difficile d'y faire des recherches.

La sensibilisation au site Science.gc.ca et son utilisation préalable étaient passablement limitées; seulement quelques participants avaient déjà visité le site Web. Ceux qui connaissaient l'existence du site l'ont découvert, soit dans le cadre d'une recherche qu'ils effectuaient sur l'Internet ou parce qu'ils en avaient entendu parler, soit par des collègues ou des documents promotionnels.

Chez ceux qui ont déjà visité le site Web, les perceptions sont mitigées. Quelques un jugeaient qu'il pouvait s'agir d'un site utile et ils avaient utilisé certaines des ressources disponibles sur le site, mais

d'autres ont eu de la difficulté à trouver de l'information ou les types de ressources pédagogiques qu'ils voulaient et, par conséquent, ils n'y étaient pas retournés.

Exploration du site Web Science.gc.ca

Les réactions initialement favorables au site Science.gc.ca ont été centrées sur la quantité d'information, la facilité de navigation et une bonne organisation. Ceux qui ont aimé le site Web s'attendaient à être facilement en mesure de localiser une information crédible sur une vaste gamme de sujets. Certains ont découvert des éléments visuels au cours de leur recherche initiale qui, selon eux, pouvaient être utilisées avec leurs étudiants; ce qui a accru leur appréciation du site.

Toutefois, bon nombre de participants ont trouvé le site Science.gc.ca visuellement faible. Cela ne les a pas incités à poursuivre la visite puisqu'ils s'inquiétaient que leurs étudiants, habitués à des présentations soignées et à une utilisation forte des composantes graphiques, ne trouveraient pas la présentation du site très attrayante.

Bon nombre de participants se sont sentis submergés par la quantité d'information disponible sur et par le truchement du site Web. Certains se disaient préoccupés de ne pas trouver suffisamment d'information dans leur spécialité; d'autres étaient d'avis que le site était trop centré sur la science et pas assez instructif sur les sujets technologiques et cette difficulté a été source de frustration. Certains ont pensé que l'information était de niveau trop avancé et trop technique pour eux-mêmes, voire leurs étudiants. D'autres ont jugé que le ton de l'information était trop rudimentaire.

De nombreux enseignants n'étaient pas certains de savoir à qui s'adressait le site Web Science.gc.ca – aux enseignants, aux étudiants ou à la population en général. Ils étaient d'avis que, si les documents – ou une partie de ceux-ci – s'adressaient aux étudiants, le niveau scolaire doit être clairement identifié de façon à correspondre à toutes les exigences des programmes provinciaux, de telle sorte que les enseignants n'auraient pas à deviner si l'information est adéquate pour l'âge ou le niveau scolaire de leurs étudiants. Sans aucune indication relative au niveau de difficulté et de complexité d'une ou l'autre des composantes en particulier, certains avaient de la difficulté à déterminer si l'information présentée sur le site Web était appropriée pour le public auquel ils la destinaient.

Certains ont été d'avis que l'information se devait d'être stratifiée davantage, de même que plus interactive et visuelle, notamment à l'aide d'hypertexte, non seulement pour introduire une information plus complexe sur un concept donné, mais aussi pour apporter des composantes visuelles ou faisant appel au multimédia, afin de susciter plus complètement l'attention des étudiants.

La clé de la réussite en matière d'organisation de l'information, selon les participants, consiste à pouvoir identifier et repérer rapidement l'information précise qui leur serait utile. Les participants voulaient avoir accès à des outils d'évaluation, des plans de cours, des devoirs et des activités, ainsi que des projets de laboratoire, qui seraient élaborés au complet sous forme de trousses. Ils voulaient également avoir accès à des éléments visuels et des animations qu'ils pourraient utiliser en classe pour susciter l'intérêt de leurs étudiants ou auxquels ils pourraient référer des étudiants désireux d'obtenir plus d'information d'une façon qui capterait leur attention.

Certains participants n'étaient pas au courant de l'expression « portail. » Règle générale, la réponse à la suggestion d'utiliser un portail a été mitigée. Certains ont noté avec intérêt la vaste gamme de documents disponibles par le truchement du portail Science.gc.ca. La position d'autres a semblé plutôt neutre, alors que d'autres n'ont pas apprécié cette approche.

Trousses pour les enseignants de Science.gc.ca

La plupart des enseignants accueillent bien les trousses destinées à l'enseignement quelle qu'en soit la source – gouvernements, sociétés, maisons d'édition.

Un grand nombre de participants étaient intéressés par la trousse pour les enseignants de Science.gc.ca et ils pensaient qu'elle pourrait bien leur être utile, que si les documents étaient bons, ils pourraient bien chercher à trouver des documents semblables ou d'autres ressources sur le site Web de Science.gc.ca. L'intérêt clé consistait à avoir accès à des ressources de nature visuelle, de qualité et correspondant au programme pour leurs étudiants, ainsi que des outils de préparation pour eux-mêmes.

Les cédéroms de ressources en direct et de plans de cours, ainsi que la collection de vidéos sur un disque DVD, ont suscité le plus d'intérêt chez les participants. Certains étaient aussi intéressés à voir quels types de sites Web le cédérom *Voyageur en sciences* leur ferait découvrir. Bon nombre de participants ont également manifesté leur intérêt à l'égard de la carte de la population. L'affiche sur les thèmes d'enseignement a toutefois suscité des réactions mitigées.

Relever le niveau de sensibilisation à l'égard des ressources en sciences et technologie

Des suggestions destinées à accroître le niveau de sensibilisation a l'égard des ressources en sciences et technologie qui sont disponibles telles que le site Web Science.gc.ca comprenaient : l'utilisation du

bouche-à-oreille pour accroître la sensibilisation; des présentations à des conférences et des séminaires; des présentations aux ministères de l'Éducation, aux conseils et commissions scolaires, aux départements des sciences à l'intérieur des écoles, ainsi qu'aux organismes sectoriels s'adressant aux enseignants de sciences et de technologie; la publicité dans des revues spécialisées; rendre disponible l'information au sujet des ressources dans les Facultés d'éducation; et distribuer des documents de promotion dans les écoles et les bibliothèques publiques.

3.0 INTRODUCTION

3.1 Background

In February 2004 and February/March 2005, the S&T (Science and Technology) Cluster office conducted national focus groups to assess the specific needs of Canadians related to online science and technology information. Results of this research directly influenced the development of and adaptations made to Science.gc.ca, which was launched in March 2004.

Science.gc.ca is a citizen-oriented web portal that presents science and technology information from across the Government of Canada and its partners. Available through Service Canada – servicecanada.gc.ca -- the S&T Cluster provides one-stop access to science and technology information from the Government of Canada and other authoritative online sources.

The Cluster uses a subject-based approach to present information to the public in an intuitive way, providing a principle channel for citizens to access Government of Canada knowledge related to science and technology. Science.gc.ca already offers extensive information on categories including energy, the environment, health, food and space. Updated weekly, the portal also offers science news, videos, games and information on science careers and Canadian science achievements.

Government Online (GOL) Context

The S&T Cluster – Science.gc.ca – was established as an integral part of the Government of Canada's (GoC) GOL initiative to provide a broad range of government information and services on the Internet by 2005. It is the goal of the GoC "to be known around the world as the Government most connected to its citizens, with Canadians able to access all Government information and services online at the time and place of their choosing."

A core element of the GOL initiative is the clustering of government services and programs from a citizen's point of view rather than the government's organizational structure. The summer of 2000 saw the creation of a Cluster Blueprint, which defined a structure for a series of subject clusters (S&T, Health, Taxes, etc.) and audience clusters (youth, seniors, persons with disabilities, etc.). The Blueprint was developed using feedback from Canadians who participated in an inter-departmental working group.

The goal of the Gateways and Clusters is to ensure seamless, one-stop access to information by transcending organizational boundaries, by first aggregating, and then organizing, information in ways that resonate with the situational needs and expectations of audiences.

3.2 Research Purpose

Past research has targeted the general public. This new research will focus on the science education community as a key segment of the broader audience for federal science information. The main purposes of this research are:

1. To explore the needs of Canadian S&T educators for S&T information;
2. To gain feedback on the S&T Cluster teacher kit to determine its usefulness for S&T educators and determine possible changes/improvements;
3. To discover the best channels and approaches for delivering S&T information to educators, and
4. To gain feedback on the Science.gc.ca web portal as a tool with which to provide information to S&T educators, including possible improvements/changes.

3.3 Research Objectives

1. Identify the preferred sources and channels of science educators for accessing authoritative science and technology information;
2. Explore the nature and extent of interest by science educators in GoC S&T information and resources and
3. Assess to what extent Science.gc.ca is positioned to respond to the needs of science educators for science and technology information and teaching resources.

3.4 Research Methods

A qualitative group method called the Intensive/Interaction Workshop Group Method (IIWGM) was employed, rather than a conventional focus group methodology. This approach creates an opportunity for participants to share not only what they know and believe to be true, but also to reveal what they do not know or what may cause them concern, or to question things that they may have seen or heard. As the purpose of this research is to explore the usefulness of the Science.gc.ca website in serving the needs of junior high school and high school science and technology teachers,

this approach was selected in order to permit the fullest exploration of participants' responses to the website. (See Appendix for a detailed description of this approach.)

Each participant was provided with "their own" computer for site exploration Within the context of these focus group sessions, teachers were given time to explore the site individually, then return to the group to discuss and explore their response to what they experienced related to the site, and how they feel that the site will or will not provide them with a resource that they can effectively use in their teaching practice.

The size of the groups was kept to six participants per session, as this provides each participant with a sense that they have more "air time" to share their ideas. This small group approach also allows participants the time they need to consider and respond in greater depth than is possible in a larger group setting.

3.5 Participant Recruitment and Moderation

The research design included eight groups in four centres (Halifax, Montreal, Toronto and Vancouver). Participants in all groups represented:

- Teaching professionals from a full range of science specializations (chemistry, biology, physics, geography, technology, social sciences)
- Resource specialists in fields related to science education, such as school librarians and/or guidance counsellors (a minimum of one and a maximum of two per group)

Group Composition

Toronto: February 21, 2006
Group 1: public and private school junior high school and high school science and technology teachers who teach in the GTA.
Group 2: public and private school junior high school and high school science and technology teachers who teach in (905) communities.

Halifax: February 23, 2006
Group 1: public and private school junior high school and high school science and technology teachers who teach in Halifax.
Group 2: both public and private school junior high school and high school science and technology teachers who teach in communities near Halifax, but outside the Halifax School District.

Vancouver: February 25, 2006
Group 1: public and private school junior high school and high school science and technology teachers who teach in Vancouver.
Group 2: both public and private school junior high school and high school science and technology teachers who teach in communities near Vancouver, but outside the Vancouver School District.

Montreal (French): February 27, 2006
Group 1: public and private school junior high school and high school science and technology teachers who teach in Montreal.
Group 2: both public and private school junior high school and high school science and technology teachers who teach in communities near Montreal, but outside the Montreal School District.

Participants in each group demonstrated a range of Internet usage levels; however, those who use the Internet rarely or never were not included. All participants have searched for science and technology resources on the Internet within the past year.

Other recruiting criteria:

- Range in total amount of teaching experience.
- Range in year taught (Grades 7-12).
- Mix of male and female.
- Mix of urban, suburban and rural based participants (Toronto: urban/suburban mix, Halifax: urban/rural mix).
- Canadian residents, working full time as science/technology educators or specialists.
- No web design experts in the groups.
- No Government of Canada employees, marketing or communications specialists in groups.

Recruitment and Moderation

All participants were recruited by Research House, a sister company of Environics Research Group. Eight (8) potential participants were recruited for each group; six (6) were selected through a re-screening process to ensure that a balance of experience and expertise was represented. The "extra" two participants were thanked and paid for coming to the session, but they did not participate.

In total, forty-eight (48) science and technology educators took part in the eight (8) focus groups comprising this research, as indicated below.

Participation in Groups				
Date	#	Location	Group 1	Group 2
February 21	2	Toronto	6	6
February 23	2	Halifax	6	6
February 25	2	Vancouver	6	6
February 27	2	Montreal	6	6

All groups were conducted in focus group facilities, and in all groups a computer with web access was available for each of the six participants. An IT technician was on-site during all group sessions to ensure that qualified technical support was immediately available should problems arise.

Each group was approximately two (2) hours in duration. Groups in Toronto, Halifax and Vancouver were conducted in English. Both groups in Montreal were conducted in French. All focus groups were audio recorded. Each participant received an incentive/honorarium of $100.00.

Sally Preiner, Senior Consultant – Qualitative Innovation, Environics Research, moderated the English language groups. Louis-Philippe Barbeau, VP Research, CROP, moderated the French language groups. Both moderators are named in the standing offer, and both have experience in conducting qualitative research among teachers.

All qualitative research work was conducted in accordance with the professional standards established by the Marketing Research and Intelligence Association (MRIA) (previously the Professional Market Research Society and the Canadian Association of Market Research Organizations).

3.6 Statement of Limitations

The objectives of this research initiative are exploratory and therefore best addressed qualitatively. Qualitative research provides insight into the range of opinions held within a population, rather than the weights of the opinions held, as would be measured in a quantitative study. The results of this type of research should be viewed as indicative rather than projectable.

4.0 DETAILED FINDINGS

This research was undertaken with the goal of gaining insights into how to best present and position Government of Canada and Government of Canada Science and Technology information as a useful, meaningful and important resource for Canadian science and technology educators. In order to gain these insights, science and technology educators were invited to discuss:

- Aspects of the teaching environment that impact educators' use of S&T resources on keeping current with information in their field, their roles and responsibilities as teachers, and issues related to computer and Internet use in education.
- The use of computers and the Internet in the teaching environment.
- Educators' use of science and technology resources available via the Internet.
- Educators' awareness and use of Government of Canada S&T information.
- Educators' responses to specific S&T resources – the Science.gc.ca website and the Science.gc.ca teacher's kit.

4.1 Context

In order to provide context for a deeper understanding of science and technology educators' needs and preferences with respect to information and resources, this research explored various aspects of their professional environment.

4.1.1 Keeping Current

One important and ongoing aspect of science educators' professional responsibilities involves keeping current with both the state of knowledge in the subjects they teach and with curriculum changes.

> It's really hard, as you say, to keep up with it all. It just seems like as soon as you get a handle on one thing, something else is coming along. It's just breakneck speed all the time, and you just have no time, especially when you're starting a new semester in the middle of the year, like now. You have September happening in February. (Teacher, urban Halifax)

While there are few major changes in the core concepts of many basic science programs such as physics, geography and chemistry, most educators prefer to keep up with new information that may yield contemporary illustrations or applications of core concepts. On the other hand, some science programs and many technology programs require regular updates as knowledge and technologies advance. Science and technology educators also conduct ongoing research to find materials and information they can use to encourage interest and enthusiasm in their students and offer

reinforcement of the basic curriculum in ways that support the diverse learning styles of their students. In order to achieve these ends, science and technology educators turn to a variety of sources to keep current with developments in their subjects.

> I try to get as much variety as I can, because I find the students learn in so many different ways. So I try to access as many print resources as I can, whether they be textbooks or sometimes just periodicals, magazines, whatever is being put out; attending the workshops, the PD sessions. Usually they have some publishers there, but sometimes there are organizations that put out material useful for teaching, like educational network type of materials that are on the Internet. You can access them. The kids can access them. Some of them put out CDs that you can use, or DVDs, or sometimes both, that you can use in the classroom. Talking to the other teachers is always helpful, and I like to try this and try that. Different things will work for different levels, so you can't use one set of material. Like one semester I'd have a course and I'd use this material. The next semester I have the same course but different students, and you can't use that material. So, it's from everywhere, magazines; whatever is being put out I try to find it. Other teachers, if they find stuff, they pass it down to me knowing my subject area, and I test it out myself, and I figure if I can figure it out, probably they can work with it. (Teacher, urban Toronto)

> I teach physics, and recently, in the past five or six years, there's a new curriculum, so the new physics textbooks have a lot of new information. What I find works well for me is to give the kids assignments, to do research and let them bring in new information to me. They don't know that they are doing that, but that's actually what they are doing. I find that reading Scientific American or reading physics magazine, which we have in the library. But a lot of my resources I find from the teachers as well. We share. We collaborate a lot. I find that's a really big part. From listening to other people say the same thing, I realize how much cooperation and collaboration there is. (Teacher, suburban Toronto)

Finding information and resources is not just the individual responsibility of individual classroom, lab and workshop-based educators. Librarians are deeply involved in locating and acquiring resources, both for the use of the classroom educator and as supplementary information for the student, often working together to identify new resources – from books and videos to websites.

> I think the key things are the authority and the currency of the sources. So National Geographic is going to be a steady go to. Discovery Channel offers some very good things. We strive to provide sort of print materials that are very current, authoritative. The popular

> science encyclopaedia requires updating. Encyclopaedia for more senior students. There are junior science encyclopaedias as well, but we use the websites for supplemental. I pre-select the websites and kind of interesting that for the science fair it was a huge undertaking, that many of the books that we ultimately purchased were not available in Canada and we had to step across the line to gather up those sources. (Teacher, urban Vancouver)

> I'm looking for new materials all the time for ordering in for the future in the library, and that would be on the web as well, following the teacher's lead. So it's a tandem thing. We have sort of basic principles of research, documentation that we are emphasizing, but we are there as curriculum support with the classroom teacher. (Teacher, urban Toronto)

In most schools, department heads or other designated staff are also assigned the task of locating resources and making them available to educators and students. One method of keeping current with new resources is to subscribe to journals that regularly evaluate teaching resources.

> We all, in our secondary schools, have department heads and usually they assume that kind of role, or they should. But we also have in our school a lead technology teacher and they have been given extra time and resources to help out those teachers who would need help in that area. (Teacher, urban Vancouver)

> A lot of the reviewing journals we get will mention different kinds of resources, so we subscribe to journals that tell us where information is and where it is being published and where to get it. And then a lot of mailings, different publishers, etc. etc. (Teacher, urban Vancouver)

Many science and technology educators rely heavily on personal contacts to gather information on developments in their subject areas and on teaching resources that may be useful to them. Advice and recommendations from other teachers who cover similar content in their own classes are particularly valued.

> I think you learn from your colleagues, and it's kind of self-selected, the people within the school that seem to be most interested in the field, and who kind of become lead teachers in various areas and sort of unofficial mentors. (Teacher, urban Toronto)

> From colleagues. In a nutshell, 'What are you doing differently? Why does that work? Why doesn't it work? What would make it better?' 'Quick, let me write this down. I'll give it a try.'

> So it's content and delivery, and I'll take whatever I can get to make myself a better educator. (Teacher, urban Toronto)

> Well, I know a fair number of people who teach the same course, and that's probably how I keep most up to speed. (Teacher, suburban Toronto)

> Colleagues, that is vital. And colleagues who have more experience. (Teacher, urban Montreal)

> From each other, but often I just find like, "Oh, you have that. Oh, I would like to borrow that." It is word of mouth and borrowing. It takes years to collect materials. (Teacher, urban Vancouver)

Information is also sought through more formal and organized avenues for personal recommendation, such as conferences, seminars, and professional listservs or Internet discussion forums.

> Well, I think our science department gets a lot of mail, and so what they will do is circulate to other members, "Oh, you know this is the Callas Conference, and there is a seminar at UBC that you might want to hear," and so for that extent … (Teacher, urban Vancouver)

> I am part of a list of sort of basically chemistry teachers throughout B.C., and they contact, they make comments about topics and where the curriculum is going, but also on terms of resources. So if there is anybody who has any ideas about where you can get this particular chemical or great demonstration for something, or just recently somebody put out a message about great news or a web-based journal, science journal. So it has been a great communication for us and a great way to collaborate with people from all over the place, and if you are not shy about using the Internet, you just pop up a question to anybody you have. "I am looking for something like this, and if you have any ideas about that…." (Teacher, suburban Vancouver)

Some teachers also find that they learn about new developments and interesting websites from their students.

> Personally, I think it's the students who often update us, because they come in with new things continuously. I have two or three computer guys. I work in a very good environment.

> We have technology, laptops – each teacher had a laptop. But students are often in contact and they're the ones who tell us, "Oh, I found this," or, "Go see this site." You know, they'll say, "Oh, Google this. Google that." And they're the ones who motivate us. (Teacher, urban Montreal)

In addition to word of mouth, advice and recommendations from colleagues, educators access a wide variety of resources in their attempt to keep pace with changes in their subjects and find resources they might use in teaching: books,. magazines, journals, science programs on television and radio, and the Internet. Most use multiple sources of information, including collections of resources and files borrowed from other teachers.

> I teach some geography, but I've also taught ESL and physics and math to adult students. That was mostly colleagues who have done it longer than I had, and we always had like a big cabinet full of books and resources and things, and they were standardized text books so you can get all the information you needed. Most of the stuff I've taught hasn't changed too much, either. But to keep up with any other changes the Internet, trying to get the most up-to-date books you can find, and that's about it. (Teacher, suburban Toronto)

> For me it's like a recreational activity. I decided to teach science because I'm passionate about it. You know, Discovery Channel on Sunday is part of my leisure time. And every time you read the newspaper, if there's an article on astronomy I'll read it and I'll see if I can't bring it to the students, or I'll see if there's a link with what I'm teaching. (Teacher, urban Montreal)

> I also buy books from a book dealer who is very knowledgeable, who can show us what's interesting to buy for high school. I bought books on maths. (Teacher, urban Montreal)

> You know, I love going to bookstores. That's where we see scientific magazines and global warming and things like that. (Teacher, urban Montreal)

> I watch the news regularly. La Presse. There are scientific magazines. One is called La Recherche, the other is Psychologies. (Teacher, suburban Montreal)

> I get a physics teacher magazine and often in there they will highlight various resources and stuff like that and direct me to different areas in that way and then just word of mouth too.

> Talking with other teachers and saying, "Well, I found this to be useful," or, "I got this here." (Teacher, suburban Vancouver)

The Internet is a primary source of information for some, particularly those who have identified particular websites that are of use to them, that they can check regularly. Others use the Internet as a way of finding out specific information on a topic that has come to their attention through another source of information. Regardless of how it is used, the Internet is considered a valuable source of information by many educators.

> I just read. Whenever I have time, I read on the Internet or read, and whatever I see that's really applicable and is not above them, I try and do it. That's all I do. (Teacher, urban Halifax)

> Usually what I do is I have three or four Scientific Americans and a few different journals bookmarked that I try to weekly look at, and between that and them asking something in class, I'm able to just go right there to the Internet and have a quick search. If I didn't have the computer right there, honestly, I don't know how I'd teach anymore. When I used to not have one, I don't remember how I did it. (Teacher, urban Halifax)

> Reading professional journals, or going online. I like finding it online and then printing it off. I like having hard copies. (Teacher, outside of Halifax District)

> For me, Internet a lot. Every day I'm in the Internet. Sometimes I get Monde Diplomatic or Radio Canada, and there's always a scientific special. I'll go and see it. It's a tool that's very useful. (Teacher, urban Montreal)

> I use the Internet, because we have computers in the classroom. If the teachers ask us for information that, I don't know, I say, "Come on. Let's go and have a look," and they go and get it themselves and we share with the other students. We are online all the time. (Teacher, suburban Montreal)

> The science textbook and stuff like that, a lot of it is outdated. So what I try and do is go online and try and sift through the material. You have to really pick and choose what you present to your kids that is not way over their heads, that they are going to understand it. (Teacher, urban Vancouver)

> I access the Internet, but it's not my source of information that I prefer. I use Internet when I have questions. Then I go on research engines, but the questions for me come from television, mostly students, magazines. (Teacher, urban Montreal)

Because of time constraints, some find searching for information, particularly on the Internet, unnecessarily time consuming. These teachers are interested in summaries and pre-screened materials that they can find and adapt for use with a minimum of effort.

> I start with the written media, because they've already done the screening of the information. If I need more specific things…. I'll go. But at least I have elements on written paper. Otherwise it takes too long. I could sit there and look.… You look for a word, and then you go and you have to read the whole thing, and "It's not that." It's like when you go to a library and you look and look and look. You spend 4 hours looking. So I prefer that they give me summaries. (Teacher, suburban Montreal)

4.1.2 Tasks and Responsibilities

When science and technology teachers identify the tasks and responsibilities that are part of their day-to-day professional lives, the act of teaching often takes a secondary place to such activities as planning and developing lesson plans and course content; preparing classroom activities, exams and assignments; setting up labs and workshops; and marking assignments, exams and labs. They also mention a wide range of administrative duties, from recording marks to communication with colleagues, supervisors, parents and students, to union responsibilities.

Planning and Development

The degree of time and the nature of the effort put into planning and development of course materials is influenced by the length of time that a teacher has been teaching a course. Most agreed that it takes a few years to develop a set of lesson plans, but even those who have developed and tend to reuse their plans said that they continue to add to and refine their course plans and materials. Some find themselves modifying their lesson plans regularly, either because the needs of the students are different, or because there is new information to be included, or in some cases because they themselves get bored with the same plans.

> I do new ones all the time, because each class, even though it may be the same course, is very different, and I can never do the same thing twice, although the material that you use

> can be the same or similar, but never is one of my courses the same as the next one, ever. (Teacher, urban Toronto)
>
> I've got the lesson plans pretty well made out, and I know I'm doing a certain subject tomorrow. I'll print it out. 'That won't work for this group.' Just cross it out. I'll do this instead. (Teacher, urban Toronto)
>
> I don't do new lesson plans every day of my life, but I'm in a position now where I'm teaching Biology 11 for the third time, and so the nice thing about that is I have an idea of where I'm going and what I'm doing. But I also have the privilege of having the time to actually do some more research that I didn't have my first year of teaching Biology 11. (Teacher, outside of Halifax District)
>
> Planning everything. Event planning, planning an exam, planning your courses. It's planning. This is my first year, so it takes an hallucinating amount of time! (Teacher, suburban Montreal)
>
> For me, I have developed a binder and there is a bunch of stuff in there. I have not been able to get that perfect, the way I would like it. It is all in there. I just have to find it and things like that. Yes, so I pull things out of a hat, and things change depending on how the classes are and things like that. I think that within the last two years I can pretty much find anything in there. It is just not looking the way I would like it to look. And it will probably never look the way I want it to look. (Teacher, urban Vancouver)

Of key importance in preparing lessons and course materials is the need to design courses that will be stimulating and interesting to their students. Some teachers also reported that they get bored teaching the same material and prefer to change it regularly to keep their presentation fresh.

> I tend to get bored, so I don't like to teach the same course more than three times at the most. The first time you're scrambling. The second time you do it better, because you had the experience from the first time, so you do some revisions to it. Then the third time maybe you tweak it a bit, and then you look for something else to teach. So I've taught most every subject going. (Teacher, urban Toronto)
>
> Trying to find new stuff so that I'm not doing the same thing over and over, but bringing in what's relevant to the class, the dynamics that the class has for that semester that you're

> teaching, as well as new technology that's coming in. Not necessarily new lesson plans, but I try to expand or change the examples, if that makes sense. It's the same curriculum; you have to teach the basics, but let's say I'm doing something in physics and something relevant is going on with physics. I'll try to bring that in and expand on it a bit. (Teacher, urban Halifax)

> I have four big binders that I change all the time. I get bored really easily. I can't teach just the same thing every day because I have three Oceans classes, one after the other. So I change it up and I add new stuff all the time. My students' attention span is very low, so I try to block it into chunks for them to do different assignments. Maybe we'll start off by having a discussion for 20 minutes and then moving on to a short 20-minute video, and then we'll move on to an exercise or something. (Teacher, outside of Halifax District)

> I have to keep up-to-date so that I don't tell them about old news. For me, keeping up-to-date requires a lot of time. I have to review my subject matter and change the text. I always have to update. And in the past couple of years, I've noticed…. I used to give classes and I thought I was really interesting. Now I don't really know what to do anymore. I always wonder why they're not getting it. Is it because they watch more TV and they're not used to interacting? There's no response anymore that I used to get. I've always taught at the same level. (Teacher, suburban Montreal)

> Well, I've been teaching for a long time. But, finding something that is motivating for the kids…. Is it PowerPoint? Is it using the computers? What am I going to work on? For me, this year, it's updating, because we're going through a reform. (Teacher, suburban Montreal)

Class preparation

Participants agreed that the actual preparation before class – setting up activities, preparing exams and in-class or take-home assignments, photocopying, setting up computers or equipment for audio-visual/multimedia presentations or lectures – consumes a large amount of their time.

> Preparing to get ready for the class in terms of looking at my computer, getting my lessons ready, doing the photocopying that I need to do. (Teacher, outside of Halifax District)

> It's preparing my activities. It's looking for them, preparing my materials. Once I have a good idea, I have to start and do it, but it's building a questionnaire or preparing a lab, but trying it out. So it's really preparing the activities for the students and making sure that they

> work well before I present them. That's what requires the most time. (Teacher, urban Montreal)

> It's preparing classes. You always have things to – materials, availability of. If I want to go into a computer lab, I have to see if it's free, if the tech is going to be there, if he's going to be with me. (Teacher, urban Montreal)

> Preparing my classes. The time it's going to take this activity. 60 minutes, it looks like nothing. But I have to try it out. I have to implement it. I have to go and do photocopies. And this is one day. There are days that you just keep turning around in circles. (Teacher, urban Montreal)

Locating appropriate resources

Access to appropriate resources was a major issue for educators outside of Quebec teaching sciences in French immersion courses. With fewer French-language resources that are curriculum-appropriate available to them, they face the task of translating curriculum-based materials into French before they can be used in class.

> I teach French Immersion biology as well as English biology, and the amount of prep that we have to do, because there are a huge lack of resources in the French…. No matter what people think, that we get all this money, we don't, and I'm constantly translating hours upon hours of labs. You know that it's just ridiculous, because we do not have that. Even on the net, I'd say an eighth or even a sixteenth of the resources that are available in English on the net are in French, so that's another aspect of it. (Teacher, urban Halifax)

Lab preparation and setup

In addition to the time involved in preparing and setting up science or technology labs, some teachers noted that a lot of their time goes into maintenance and repair of equipment.

> Setup of equipment and repair of equipment. Some of it's aging, and then kids abuse it and it requires repair, and learning how to use it better, like a computerized wheel-like machine. There's money for it; there's money for the equipment, and it's pretty expensive. "Here's the manual. Try and read it yourself" kind of thing. There's a lot of time spent reading the manual and figuring it out, and then, "Okay, I'll leave work at 3 and I'll go over to a shop

> and watch them use it and work with a guy and try and figure it out that way." So it takes a lot of time. (Teacher, urban Toronto)

> I guess because I am in the shop so I worry about time lines for my kids to get projects done. In my field I have quite a varied range, because our kids are very adaptable, quickly. Some kids are just very slow naturally. Try to get them to a point…. So like, I put set up. I try to have everything set up for those different groups after a couple of weeks. I have to go in and do jigs and different sponsor aids so there is a quick transition, like prepping all your woods, etc. Basically, for the workshop I would say, "Okay, I know these kids are at this point and I only have these 2 machines for the whole class to work on." I have to be able to take them through it quickly. (Teacher, suburban Vancouver)

> Probably just prep and actually physical maintenance of my lab, because it is pretty old. It is a computer lab, and it is just, you know…. I have 3 or 4 computers every morning that aren't working properly, so I am in there. That takes up a lot of time, but otherwise it is just to prep to make sure we know where we are going in the classroom. It is pretty good, though. (Teacher, suburban Vancouver)

Marking and Administration

A number of participants mentioned marking of exams, labs and assignments as being one of the more time-consuming aspects of their professional lives. Others found the weight of administrative duties to be the most onerous aspect of their day-to-day jobs.

> Marking, no doubt. I have been teaching eight years. I have been teaching the same courses for quite some time now, and I would say marking takes up most of my time. Prep material now…. If I have time, I go through it and revamp and takes things out that I do not want to teach any more or I am bored by, but grading and marking, that takes up the most. (Teacher, urban Vancouver)

> Marking and administrative time. E-mails [from] the principal. That's part of the problem of having technology in the classroom. I spend an hour a morning just responding to e-mails from department members, usually 8 or 10 from administration, and parents also. It's very time consuming. (Teacher, urban Halifax)

Coping with Job Pressures

Educators commented on several other issues which, while not necessarily time-consuming tasks, were significant challenges they face that add to the overall pressure of the profession. Many reported a feeling of being overworked or lacking time to do all the things they want to do in order to plan and prepare their courses and keep themselves up-to-date.

> The only thing I would like to add: in my work, they don't give me enough time to do this. I would need more time allocated for…Well, to do research, to improve myself, to get into things more deeply, because I have to do it evenings, weekends. I'd like to have time on my work time to do that. Maybe because I'm getting old. Ideally, it would be to have time off to be able to update yourself, so that we could create our own course. (Teacher, urban Montreal)

> I'm computerizing the library. Three-quarters of the books are not in the computers. They're asking me to do this at the same time as I'm doing the rest of my work. (Teacher, urban Montreal)

Some are concerned about overcrowding, class atmosphere, and lack of respect for the teaching profession, not just among students but also in the community and the government.

> Dealing with students that exhibit lack of respect for other students, for the place where they are and for teachers. (Teacher, urban Toronto)

> I think it's the fact that you seem to be the one person who's responsible for everything in terms of those above you come and download things on you, the students you're responsible for. So there you have that accountability. The parents – you're accountable. The Ministry – you're accountable. It weighs very heavily on you, and I find that now you are not given the respect from the students, from the parents, from whatever. You're working very hard and you don't get the recognition for all that you're doing, and you get deflated. (Teacher, urban Toronto)

> Too many students in one class. For a technology class, the class size is too big. You've got 20 teenage boys with weapons in their hands, well tools in their hands, and it can be crazy. Even if people are on task, still you've got one or two who are going to affect the entire classroom, and then equipment issues as well. (Teacher, urban Toronto)

Day-to-day Responsibilities and Duties

Day-to-day responsibilities of science and technology teachers cover a broad range of tasks, including: class and lab preparation; teaching; marking tests and exams; interacting with students, colleagues, administrators and parents; research; long-range planning; attending meetings; handling administrative tasks; supervising extracurricular activities at or sponsored by the school; and professional development. Clearly, much of their time is focused on matters other than the subjects that they teach, and multi-tasking is an essential skill.

Resources that will cut down on the time spent on any of their regular responsibilities, without causing a reduction in quality, would seem to be well accepted. On the other hand, anything that is perceived as taking more of their time would not be welcome.

Listed below are the written responses of the participants in this research to inquiries about their day-to-day professional tasks and responsibilities.

Tasks and Responsibilities
Halifax
• Class preparation • Make up projects/new activities • Lab preparation/setup/lab clean up • Translating labs • Test preparation • Make up tests, assignments • Conduct labs • Instruction (time with students) • Direct instruction • Individual testing, oral tests • Individual instruction • Correct papers • Correct labs • Marking/at school/at home • Record marks/ record on computer • Take attendance • Tracking attendance • Classroom management • Give extra help at night by email • Extra help at noon/before class • Answering questions

- Student-teacher meetings/Meet with individual students
- Talk to students, joke, counsel them
- "Friendly harassment" of students
- Observing students
- Disciplining students
- Supervision/duties
- Coach/coaching soccer/golf
- Extra-curricular
- Organizing social events
- Chaperoning dances
- Supervise after school
- Call parents/email parents
- Parent communication/parent-teacher
- Check mailbox
- Read and respond to emails
- Looking on internet for resources/ideas/Internet searches
- Research
- Read about our fields in magazines/professional journals
- Scientific developments/technology
- Research on internet for new materials
- Reading resource materials
- Update/maintain personal website
- Making summary notes
- Post notes/assignments online
- Revamp notes
- Type out notes, sheets at home
- Cut out relevant material
- Buying lab materials
- Borrow textbooks
- Getting supplies
- Buying supplies
- Finding materials
- Xerox/photocopy – information, activities, overheads
- Photocopy for students
- Posters in room
- Book library VCR, LCD – collect them
- Booking labs
- Organize guest speakers
- Powerpoints
- Discussions with colleagues
- Conference with other teachers
- Collaborate with other science teachers
- Talk to other teachers during breaks
- Cleaning desks/classroom
- Meet with guidance
- Meet with administration

- IPP and resource meeting
- Department head meeting
- Adaptation meetings
- Staff meetings
- Resource meetings
- Text control
- Announcements
- Surveys
- Redoing curriculum
- Curriculum nights
- Teaching methodology
- M.I.
- P.D.
- P.F.I.
- Modifications and adaptation – forms
- OHS
- Prepare for inservice
- Teacher upgrading
- Sub calls
- Prepping for subs
- Write reference letters
- Referrals
- Supervise teachers
- Union work
- JOHS committee
- IPP plans and behavior plans
- Work with teachers to implement policies
- Deal with administration

Montreal

- Préparer cours (Lesson preparation)
- Préparation de cours (lesson planning)
- Planification (Planning)
- Préparer les exercises. (preparing exercises)
- Cours (Lessons)
- Préparation de cours (Lesson preparation)
- Préparation d'activités avec étudiants (Preparing activities with students)
- L'enseignement (Teaching)
- Récupération avec les élèves (upgrading with students)
- Sorties avec les élèves (outings with students)
- Orienter les jeunes (providing direction to students)
- Répondre à leurs questions (reply to their questions)
- Discipline
- Corrections
- Étudiants enrichis (Gifted students)

- Communication avec parents (communication with parents)
- Rencontre de parents (meeting parents)
- Lecture – recherche, biblio et net (Reading – research, library and net)
- Prévoir matériel – labo, photocopies (Plan materials – labs, photocopies)
- Préparation de diaporamas (Preparing slide shows)
- Préparer matériel labo (preparing material for labs)
- Locaux à réserver (Reserve classrooms)
- Matériels à réserver (Reserve materials)
- Visionnement (Preview)
- Suivre mon programme (following my programme)
- Planifier les laboratoires (plan labs)
- Essayer les laboratoires (trying out labs)
- Discussion avec le technicien (discussion with technician)
- Discussions avec collègues (discussions with colleagues)
- Réunions avec direction (meeting with management)
- Réajustements selon la clientèle (readjustments depending on clientèle)
- Prêts de matériels (loan of materials)
- Suivre la demande des enseignants, préparer la documentation (follow up on teachers' requests, preparing documents)
- Montrer les étapes de recherche en bibliothèque (inform students about various stages of research in a library)
- Formation pour la réforme (Training for Reform)
- Lecture nouveaux programmes (Reading for new programs)
- Monte de cours, enseigne, responsable de l'équipe de profs. (setting up lessons, teaching, responsible for teachers' team)
- Référence, achats (References, purchasing)
- Surveillance (Surpervising)
- Récupération (upgrading)
- Pondération GPI internet (Weighting, Internet)
- Rencontre département (Departmental meetings)
- CEE conseil enseignants (Teacher's Board)
- Encadrement d'élèves (Structure for students)
- Santé et sécurité au travail – représentante (Safety in the workplace - rep)

Toronto

- Prepare/organize lessons
- Teach lessons
- Counsel students
- Discipline
- Mark
- Talk to parents
- Set up equipment
- Repair equipment
- Order supplies
- Outside speakers

- Field trips
- Talk with other teachers – admin, support staff, guidance
- Professional reading
- Manuals
- Check homework three times a week
- Prepare schedules
- Make weekly plans
- Get resources from internet and textbooks - all formulas are supplied by texts
- Book computer time/lab time/library visits
- Look at our past resources (binders)
- Use the internet
- Notes for students to copy
- Review overall school calendar
- Course binder (PLC/Team teaching)/course outline
- Day planner
- Computer assignments
- Research topics – projects
- Independent assignment
- Gather resources for the day (maps, overheads, chart paper)
- Library resource
- Do group assignment/group project once/month (6 students)
- "Chunking" of material – mini lessons with a lesson
- Review yesterday's work
- Course outline/notes/lesson on website
- Assign daily homework/give problem assignments
- Fast track students who do well
- Do individual assessments – work on weak study areas with student
- Teach a lot of ESL students – give them extra time, help, have a lot of preparation
- Meetings
- P.D. out/school
- Remedial
- Create A & E
- Evaluate texts
- Talk with caretakers re: plant issues
- Assemblies
- Attendance/correct attendance
- Coach basketball
- Photocopy

Vancouver

- Lesson preparations
- Make tests
- Lesson planning – night before, morning
- Planning – worksheets, making tests
- Internet searching

- Review of lessons
- Creating rubrics
- Student mentoring
- Dealing with students' learning and behaviour problems/issues
- Mark assignments/record marks
- Marking/grading
- Evaluations
- Attendance
- Interaction with parents
- Computer – check emails (communicating)
- Voicemail
- Talking/communicating students/parents/co-workers
- Extra-curricular activities/coaching, sponsoring teams/clubs, talent shows
- Consulting curriculum
- Resource gathering that includes pre-selected websites
- Preparing demonstrations (Powerpoint/labs)
- Processing library materials
- Internet – other resources
- Set up labs/setting up and checking equipment/computers
- Pre-reading material (books, watching videos)
- Setting up equipment/classroom/labs (set-up/prepare, demonstrate)
- Prepare field trips
- Online research/activities
- Online presentations
- Collect materials – print, audiovisual, online
- Check teacher's guide
- Book computer/science labs
- Book audiovisual equipment
- Class schedules/booking classes/last minute – flexible scheduling
- Tasks for student assistant/service student
- Collect specimens for labs
- Photocopy
- Update website
- Consult with other teachers/collaborate
- Collaborative planning – cooperative teaching
- Teams/sharing ideas with other teams
- Work with student teachers and universities
- Meetings
- Meetings with counselors and administrators re: students
- FA's
- Read novels/materials for library
- Administrative work – invoices, buying, etc.
- Buy books
- Buy science equipment
- Teacher librarian preparation – periodical/newspaper
- Order supplies/needs/materials

- Check for availability of technology
- Text evaluation

4.1.3 Issues with Computers and Internet Use in Education

Teachers' attitudes toward the use of computers and the Internet in education are an important element of their response to Internet-based information resources. While many participants were regular Internet users and appeared quite comfortable with computer and Internet use, a few were not pleased with the growing focus on computers and computer-based resources in the learning process.

Level of Comfort

Some teachers indicated that they do not have a good level of comfort with computer use. Among these are older teachers who had hoped to reach retirement without being required to become computer and Internet literate, and do only what they must. For some, it is more a matter of preferring older, less complex, more personal ways of doing things; for others, the learning curve has been steep and they have difficulties using certain software or navigating the Internet.

> I myself am not that comfortable with that technology. I was hoping to retire without using computers, but it didn't work out that way. You really did get forced about two or three years ago. I made my stand, and I'm going to lose. So I've learned. I can e-mail. I can do this, that and the other thing, but I'm not the greatest on cutting and pasting and doing that. So I'm not that comfortable, but if someone helps me, like our librarian, then I'm good. (Teacher, urban Toronto)

> No, I'm not, and I make no bones about it. In fact, I have mixed feelings about computers. They are a blessing and a curse. (Teacher, suburban Toronto)

> That's one of the things that I'm sort of in the twilight of in my career, and I do miss the olden days where you'd actually speak to people instead of e-mailing. I'd much rather talk to somebody, and I'd much rather use the blackboard and overhead projector than use complex technology. (Teacher, urban Halifax)

> Sometimes I get lost. I forget where I was going. On the Internet you have to go "preceding page," "preceding page," and it takes a longer time. It's a question of time. (Teacher, suburban Montreal)

A number of teachers noted that their students are often very computer literate and highly competent at many computer tasks. Some indicated that their students use the Internet readily, and some do research related to school in order to bring questions or topics to the attention of their teachers.

> The school, the kids even more than the adults are wildly computer literate to the nth degree. I run a newspaper there, an opinion piece, and they lay it all out. I'm the faculty advisor. I have to be the moral probity of the newspaper, but as for anything else, they are wizards on the layout of a newspaper. (Teacher, urban Toronto)

> They like to find the most obscure thing, and they get such a kick out of you saying, "I didn't learn that in university." They're like, "Ha, ha." Oh yeah, because I'll share it with the class and they kind of get a kick out of it because it's always something weird and obscure. It gives us a kick, and with the LCD we can kind of go to the Internet and look at some things, and like you say, it just ends up being sometimes a class itself. (Teacher, urban Halifax)

Reading, Comprehension and Critical Thinking

Teachers, even those who are comfortable using the Internet themselves, sometimes expressed concerns over the effects of Internet use on their students. Some were concerned that students were not always able to apply critical thinking to information found on the Internet; they noted that some students seemed to feel that if it was on the Internet, it must be true.

> I find that comprehension skills are severely lacking, because technology has made everything so available that if they need to know anything, even if you don't tell them, they can go research it on the net. Anything they want to know, they bring information and they show you. "But it's written here, how could it not be true?" I say, "Well, what do you think about it?" I find critical thinking, we're losing it. I also find that the kids can't read and understand. Sometimes I find myself having to interpret a question for them, and it makes me wonder what's going on with comprehension. (Teacher, suburban Toronto)

Others noted a real problem with plagiarism – students finding and downloading information on the Internet and handing it in rather than doing critical research themselves and writing up their results. The real concern was that this kind of plagiarism does not appear to be motivated by a desire to cheat, but rather that this is what students believe research to be.

> They can find all kinds of information on there. We have three computers in the classroom, and at break or whatever, they start going on it and they can find all kinds of information, but I don't know if they can sort it out to use it effectively. Or they'll just punch something in, "Okay, this is good." They download a lot of the information and pass it in. (Teacher, outside of Halifax District)

> So I find that sometimes they'll go on the Internet, but they find it a bit overwhelming with all the stuff. You can tell when they've gone into the Internet; they've just downloaded it and just handed it in as an assignment. They do that often. We have to address plagiarism all the time. (Teacher, outside of Halifax District)

Teachers also expressed concerns over the trend away from reading books, and attributed this to the growing use of the Internet. For many of these teachers, the Internet is a mixed blessing – it can enhance their own research and teaching, but at the same time, its long-term-effects on students are undetermined and may potentially have negative consequences.

> There are advantages and disadvantages. I mean, you can get some interesting information. They are wonderful typewriters, things like that. But you know, I think that some people have forgotten how to read. I noticed that some of the kids, even when I've been teaching adult students, are really adept at the computer, but reading The Great Gatsby was painful for these people – absolute hell. (Teacher, suburban Toronto)

> I don't want to be a slave to it, but if it enhances the unit or it's a method of investigating an issue, we do it. If it won't help it, we don't. I encourage the kids to go to the library or use the Internet, so all the kids will just get on the Internet and get it. Whatever happened to going and getting a book? I don't favour one over the other, but I'd like them to try both in the class. (Teacher, urban Toronto)

> Internet in my job is 50-50. For the students, 10 percent. Otherwise you lose them. You have to have a mirror everywhere. We want to get them to look in books. It's when they sit on the computers that we lose them. You have to say, "You can go on the computer, but 15 minutes." (Teacher, urban Montreal)

4.2 The Role of Computers and the Internet in Teaching

In general, science and technology teachers acknowledged that computers and the Internet are a significant and growing part of the educational environment. Access to computer technology in the library, the lab and the classroom is becoming increasingly common, and the use of the computer and computer-based resources in preparation and planning, teaching and administration is growing.

Access to Technology in the Classroom

In many schools, the introduction of computers into the classroom and library is a matter of policy. In fact, teachers in Montreal noted that the curriculum in Quebec is being redesigned to take full advantage of computer and Internet capabilities, and all courses will require computer use.

> My college has been going very tech and computer-oriented in all the things we do administratively, even in some of our teaching. So there are more and more things we are going online for. I say that, and I'm talking computers purely. There's been a learning curve for all of this for a lot of the people at our college, whether they're teaching Humanities or Science Tech and things of that nature. (Teacher, urban Toronto)

> All of our classrooms have computers that are hooked up to our network, hooked up to the Internet in our classrooms. (Teacher, outside of Halifax District)

> We have 25 computers there [in the library], so we can accommodate a class, but there are about three computer classrooms and video, and a classroom for videography, which is full of computers, so it's one of those sites. (Teacher, urban Toronto)

> We have a librarian who works in conjunction with everybody. I've brought them down. They have a little area off from the main library and it's like a computer little mini-lab, and we've gone in there and she puts us on different sites and they've researched as it pertains to whatever we're doing. (Teacher, urban Toronto)

> We're not there yet, but that's where we're going. (Inaudible) look for something very specific. The publishing firms are doing material that has links that have been checked out, that have been approved. So that's coming. (Teacher, suburban Montreal)

Computers in the classroom are also being used to facilitate learning for some students with disabilities.

> The new technology that is coming out is quite interesting. Yesterday one of my students who is dyslexic had got the new personal program, and it's excellent. I thought, "Oh my goodness. Even teachers would find it useful." It takes text and it can scan it in, or you can type it in or you can email it to the resource teacher. You can plug it in and it'll read back what it's saying. (Teacher, outside of Halifax District)

Some teachers, however, noted that at this point, the reality of technology in the classroom is not living up to the goal. Resources are limited in some schools, and equipment is scarce or not well maintained, or not sufficiently up-to-date to meet the demands.

> I have one computer, and that's another pain in my life. We have computers in every room, but whether they're going to work on the day or not is another thing. Plus I do a lot on the computer with my students, because I like to keep up-to-date all the time. Whether it's an image of the tsunami sort of taking off across the ocean or whatever, I like to give them a visual. They send me really good things that they've found on the Internet themselves, and then we'll show it in class. But I have to take the LCD from upstairs in the library, which is on the next floor. You have to find somebody with an elevator key and then get it hooked up in your room. Sometimes they've bent the cables so much that all the colours are distorted. (Teacher, outside of Halifax District)

> For my time it's about 25 to 30 percent, because I must say, at the school where I teach computerization – it's sort of a poor area. We don't have all of the resources. And in the library there's a…. But you have to fight for that computer room. I probably use it less in class. Although in the science department we now have a projector, so I now use the CDROM, because these are things that are easy to carry and bring in with me. If one day we could have the Internet wireless, then perhaps I would work more with the Internet in class. But now it's only about 25 percent. (Teacher, urban Montreal)

> They gave us the Teacher's Resource Manual this year. It is simply a CD, and in order to access that on a daily basis each day, you have to load it; you have to go through it. There's not a hard copy with it. Sometimes I'm debating with myself: is it better to have a hard copy, or is it better to have a CD? But here's a situation where I basically just started going to the printer and printing off a copy for each of us, because some days you go in and you can't get

> the computer loaded; you can't get the computer started, and this is down and that's down, but you want some materials. So we often do have information overload, and it's difficult to manage. (Teacher, urban Halifax)

> As a biology teacher, Grade 12 biology, I'm always trying to go a little bit above the curriculum so that the kids have a lot when they go to university. I'm really big on visual learning, because that's probably the best way, I think. I learn as well, but you can't do streaming video. Our Internet's not fast enough. You can't load it. We have Deep Freeze on there, which means everything that you load is gone as soon as you close your computer. You have to re-load everything. You've got a streaming video that the kids would love to see, and you're sitting there, and you have to go in at 6 in the morning to load these things so they're ready for class. We just don't have the time. (Teacher, urban Halifax)

Use of the Internet in Lesson Preparation

A number of teachers indicated that they access the Internet regularly, even daily, in order to keep up with information that might be useful in their classes. Some teachers said they use the Internet exclusively – or almost so – in lesson preparation because there are no suitable textbooks available. Others said that they prefer to put together their own instructional materials from Web sources.

> In terms of the science and technology, I don't need that much stuff in terms of the updating, because I teach geography. So a lot of it is natural systems. It is looking up information on hurricanes and stuff like that. If I want to keep up-to-date, what I usually do is, before I teach it, maybe a week before, I will look up new information on the Internet or I'll look up old sites that I've referenced before and see if they've changed. (Teacher, suburban Toronto)

> I don't have a textbook. I teach Oceans 11, and there's no real textbook for that, so I'm sort of gathering a lot of information as I go along, most of which I get at home, because I find at school I can't sit down long enough to do anything of any import before other things start to interfere with what I'm doing. So I'll just go home and do it for an hour and a half, that kind of thing, and there are certain key words I plug in and just see what pops up, any different than what was there last month. (Teacher, urban Halifax)

> But as far as searching online goes, I do that on a daily basis looking for, as you said, new approaches, new information. Maybe there's something easier. I have some students right

> now this semester who are taking grade 11 biology, which is what I teach, but they're at an upper elementary level. So all of a sudden right now I'm trying to focus on going online and finding some resources that are maybe at their level. So I'm online searching all the time. (Teacher, outside of Halifax District)

> With the technology that exists right now and webpages and Internet resources that have developed and there is more and more…. Of course you have to learn to figure out the good sources from the bad. I use specialized sites on the Internet to distribute them to the students and we work on that. There are no books that are up-to-date. (Teacher, urban Montreal)

> I don't use schoolbooks. I use the Internet to develop my courses. (Teacher, urban Montreal)

Use of Computers and the Internet in the Classroom

Teachers use computers and the Internet in different ways in their classroom teaching. Many indicated that they use Internet-based resources as visual aids to illustrate or complement their lectures. If they have the necessary equipment, they may visit actual websites that have useful and relevant information during classes; others will download material and present it to their classes in PowerPoint or other multimedia formats.

> I take my kids to the computer lab to do web-based activities. I get them to, as a project, make PowerPoint presentations. I have an LCD in my classroom once every week to two weeks at least for one period showing them sites online or just even a PowerPoint presentation that I have prepared about whatever topic we're talking about. (Teacher, outside of Halifax District)

> I teach Social Studies and a lot of the uses that I use for the Internet are just to supplement. One use, for information anyway, is the supplement we are talking about. Last week we were doing Louis XIV, and there is Google. You can Google Versailles, and there are a lot of great sites in there that the textbook would not be able to provide, like tours of the palace and the grounds and things like that. And the kids enjoy that, and I think it enriches the learning experience. At a different level we were doing Vimy Ridge, and again, the textbook is lacking a lot of the visual materials for a lot of the visual learners, so you can supplement that with online materials. That is just one way. (Teacher, urban Vancouver)

> As far as the Internet, for when I am teaching science, I usually focus on the basics of the basic concepts. So that is not going to change. Newton's Laws are not going to change, so I focus on that. Then when it comes to trying to adapt it to something with current examples, that is where you bring in a website. I am lucky to have a computer in my room that is hooked up to a projector, so I can actually go to a website and we can look at an example right there. So I use that more for trying to keep it current, but most of the concepts, especially for grades, eight, nine and ten, are not detailed enough, so they need the latest research of whatever is going on. You are teaching courses. That is not going to change for them. Providing examples for them to look up stuff that is a little more current. (Teacher, urban Vancouver)

> I find with teaching biology, especially when you do the microbiology stuff, the quality of our microscopes and our science stuff, you do not get a really good idea. So I make a lot of PowerPoint presentations with pictures and videos and stuff that I have found. But it would be kind of nice to have that stuff on a website, mainly for the pictures. I was talking about algae and I assumed everybody knew what algae was, and there were so many kids that said, "What is algae?" They think it is the green stuff in the shower. It is seaweed, you know, like when you are walking on the beach. Beach? I pull up the website. To be able to make a website with lots and lots of pictures and videos for all these kids who do not really get out in the world and look at it. (Teacher, urban Vancouver)

> I mainly teach physics, and right now I am working on trying to integrate more computer stuff into my lessons, and so I am spending a lot of time on the Internet. Computer simulations other types of technology that may receive data and then I can plot it on the computer or something like that. I think in physics there are quite a few concepts that are difficult to understand. They happen quickly, and we talk about them, and then students sometimes don't see them as I see them. Or I have seen them over and over again, so with a computer simulation or something, I can slow it down. I can show them exactly what we are looking for, things like that. (Teacher, suburban Vancouver)

Some teachers observed that in all courses now, there are at least some aspects that require computer use by the students. In some courses, assignments can only be completed using specific software. The research component of some courses includes Internet research. In some schools, teachers post assignments and list suggested readings and resources on their own websites and communicate with students and parents via the Internet.

> It's very important. They really can't do the curriculum without it. None of the courses that I teach can they get through, and unfortunately we're in a lower income area, and so we rely very heavily on the computers in the school, because they don't have them at home. (Teacher, urban Toronto)

> It depends on the course, depends on the unit. In almost every course there certainly are units that have to be done on the computer, whether you're teaching careers and you're doing resumes and things like that or career research. In every course in most classes there is a research component, and that's all done on the computer. Proper citation, APA or MLA citations are taught, and things like that. So, it's part of every course, even including French when I've taught French. For some, it's more important than others. (Teacher, urban Toronto)

> We are encouraged to develop websites and to make websites, and I do that. It could be both. Mainly it's for me to develop websites to allow my students to gain access to notes, assignments, important information, dates, hyperlinks to other websites. There could be an activity that I might design that would use creative PowerPoint, creative website as a product. (Teacher, outside of Halifax District)

Increasingly, publishers of school textbooks are providing online resources for both students and teachers to supplement the texts; teachers use these, and recommend that their students use the appropriate resources as well.

> We do use the computer. I go probably three times a year, I go down to the computer room, and I show them all the websites that we use. We now have a new textbook, and as a matter of fact we're putting in service tomorrow on the new textbook. I showed them all the web support that they have. (Teacher, outside of Halifax District)

Use of Computers in Administration

Computers and electronic communications are being increasingly used in administrative duties as well. Teachers and administrative staff communicate via email, and teachers record attendance and marks into central databases.

> At my particular school we have online attendance. To some degree we have online reporting of marks. We have online updates about attendance if a kid is missing 3, 6, 9, 12

> absences. We're expected to do marks, or to at least report them at the end of every set period to the computer, to data base. (Teacher, outside of Halifax District)

Use of Internet Sites by Teachers

When asked how they use websites in their professional lives, teachers listed a range of uses for the websites that they frequent. Many of their uses involved research and class preparation, and looking for ways to enhance classroom lectures and supplementary resources for their students.

How do you use this site? – General Responses
• Research • Demonstrations • Reinforcement • Review • Expand curriculum • For worksheets, animations, interactive quizzes. • Ideas for labs • Ideas that I can use in my classroom. • Look for lesson plans. • Look for explanations for different themes. • Classroom demonstrations. • Explaining a concept. • Learning tools • To get lesson plan ideas/ Lesson plans/information • Videos/new research • Read articles • To get pictures or to give out to students as resource • To add visuals to my lessons • To get adapted science work for students with special needs • Research information and find pictures • Data for graphs, tables, updated information • To use in helping to add to lessons/new resources • As a reference for myself and my students • Extract basic information. • Attain other related links. • Get current news information. • Some printable resources for class • Great online video and interactive sites on current topics • Great to find out quick facts on many topics • Use databases for magazine and journal research – EBSCO • Helps me learn how to explain something • Make games and crosswords • Information – recherche documentation (Information – search for documents)

- A quelques reprises préparation de cours – répondre aux questions d'un élève (a few times for lesson preparation – answering student's questions)
- Recherche, consultation, utilisation en classe pour les élèves (Research, consultation, use in classroom for students)
- Chercher une information en particulier, approfondir une notion, vérifier une information (Seeking out specific information, in depth knowledge of an idea, check out information)
- Ce sont des moteurs de recherche, j'y tape des mots clés pour trouver des informations spécifiques à un de mes cours, des images à montrer aux élèves, des idées d'activités d'apprentissage (Research engines, I type in key words to find specific information for a lesson, images for students, ideas for learning activities.)
- Permet de connaître les services, les accès (Informs about services, access)
- Permet de connaître les connaissances humaines (Allows you to find out about human knowledge)

4.3 Internet Science and Technology Resources

In order to gain insights into how to best present and position Government of Canada S&T Internet resources, the research examined how science and technology educators identify useful websites, what websites they currently use, and the methods they follow in locating sites of interest.

4.3.1 Identifying Useful Internet Resources

Characteristics of a Good Website

Teachers identified a number of key characteristics of websites that they would consider good resources, either for them as teachers or for their students:

- Good presentation, with multimedia, good and interesting visuals and animations.
- Well-organized so that material is easy to find.
- Professional and credible.
- Well-designed, easy to use, free of technical problems, difficulties with loading pages, etc.
- Appropriate level of difficulty, with materials that are identified for different age/grade levels.
- Interactive.
- Teacher's resource sites that offer well-designed evaluation materials (worksheets with answer keys, etc.)

These are the characteristics that teachers most often refer to when discussing a website's usefulness – or lack of usefulness – as a resource. In their own words:

> I don't want to say simplicity, but to the high school level, nothing too into the university levels. So, simplicity. (Teacher, urban Halifax)

> Multi-media, that's the visuals. Often when I refer students, I'm looking for tutorial style, things that they can interact with. But if I'm looking for a thing to use in my lessons, it's visuals; it's presentation. (Teacher, urban Halifax)

> One that's rigorous, that's well made, and no bugs. When things bug you, abandon them. You click on a link and it doesn't work, error, the page doesn't come up. I want efficacy. I like things that are recognized, serious, professional. When it's a page and I don't know the author, I don't know where it comes from, it doesn't ring a bell, I don't really believe it. (Teacher, urban Montreal)

Well indexed, key words on top that you can find your way. (Teacher, urban Montreal)

Presentation. It has to be pleasant. It has to be nice, not too busy, adapted to our clientele, user-friendly. (Teacher, urban Montreal)

Symbols to find things so that you are not searching all over the place. You type in what you want and it is there. Lots of stuff. Pictures and videos, and there are hundreds of them. So I do not need to go there and go somewhere else and find another. I just have them all there. And set up so that, if you wanted to, you are going to recommend to the kids, stuff that kids would like on it, like interactive stuff, that they can follow along and press buttons as they are going. (Teacher, urban Vancouver)

As a teacher's resource, the sites I find myself back on are ones that have workable worksheets, ready to go. You just print them, with an answer key built in so it is simple. It makes my life a lot easier. The kids can look at it and so as a teacher's resource to have those answer keys and those worksheets on the go. (Teacher, urban Vancouver)

Simple to navigate, comprehensive, visually pleasing and organized in the sense that there is a real simple, basic framework for someone coming to that. And that is all they want to take away. That is fine; that is helpful. Then to give you opportunities to go as far as you need or would like to go. I like the ones that tell you what they will tell you, they tell you, and then they tell you what they told you. (Teacher, urban Vancouver)

I think it should be interactive for it to be useful. I do not like ones with advertising. That is distracting, and often you are not getting credible information with those. I like ones that I can have the whole class using and it does not crash and they like using it. (Teacher, urban Vancouver)

For example, if I looked online for an animation on protein synthesis in Grade 12 biology, you could get ones that I don't understand. They're just completely complex. Then there are ones that are too simple. The Grade 12 level is kind of that one that's in the middle. They mention most of the stuff we do, but they don't go into all the detail of all the complicated enzymes involved and everything, and that's what I'm looking for – the one that covers what I'm covering, doesn't go too far up and doesn't go too far down, and it visually looks good to them. (Teacher, urban Halifax)

> I go to a lot of ones which have nice diagrams, either black and white or colour, that I can use to maybe duplicate or re-draw, or go to sites which have things in a clear and concise language rather than very, very technical mathematical diagrams. (Teacher, urban Halifax)

> I would say about the animations, I was just recently doing plate tectonics and the kids can't get their heads around it at all. There's a really great interactive site that you click on the mouse and you can move the plates apart and it'll show you the volcano shooting up in the middle of the sea for Australia and then what happens when it sub ducts. Now you move it another way and the plate goes underneath. (Teacher, outside of Halifax District)

Teachers' written explanations of why they use the websites that they do, and what they consider to be the best websites that they use, further develop the picture of what characteristics a website must have in order to be considered a good research and teaching resource.

What makes it one that you use?
• Diagrams • Videos/animations • Easy to find information (quick)/simple to find things • Layout – is easy to read/see • Simple to navigate • Very user friendly • Gives links to other relevant sites – Scientific American • Organization, amount of resources • Excellent animations/videos • Keeps me up-to-date/has up-to-date information • Good, clear easy to understand animation • Colorful • Interactive • Information is pertinent to course • Credible/legitimate information, scientific institutions, etc. • Information is readily available • Numerous options • Broad based (variety of biology topics covered) • Keeps log of old information • Has worksheets ready to go built by teachers for teachers • Set up to be interesting for the students – interactive and written at their level • Have lesson plans or worksheets that can be printed and used • Accessible to students/students can use it as well. • Non-commercial/no advertising • Comprehensive

- Visually pleasing
- Detailed, easy to navigate content
- Answer keys
- Guided classroom activities
- Teacher's resource
- Good visuals
- Good pictures
- Flash component
- Flexible
- Doesn't crash
- Canadian.
- Not too much information.
- I know what I am getting (no/few surprises).
- Excellent activities! (for students)
- Quick information.
- Good ones – give me good ideas.
- Information vulgarisée que je peux facilement transmettre à mes élèves (Simplified information that I can easily convey to my students)
- Complet, sérieux, rigoureux (Complete, serious, rigourous)
- Fiabilité de l'information qui s'y trouve (Reliability of information that you find there)
- Sources sérieuses, professionnelles, reconnues (Serious, professional and reputed sources)
- Parce qu'ils me donnent une multitude de choix pour chaque mots clés. Par exemple dans Google – 121 000 sites pour Chimie 534 (Because they offer a multitude of choices for each key word, For example in Google – 121,000 choices for chemistry 534)
- Pour connaître les prix, les frais d'installation (To find out about prices, installation costs)
- Permet de connaître les situations dans les pays même si pas trouvé (Allows you to get information about countries even if you did not find what you were looking for.)

What is the best science website you use?

- McGraw Hill website – It is very easy to use, it is very relevant to my curriculum and it has various types of learning styles on its site that are very technology/LCD friendly.
- What makes a site "the best" is that you can go to the site, get what you want quickly and leave with your needed information.
- # 1 – How Stuff Works – broad applications, easy to use.
- Biology corner – clearly defined subjects, easy to use, has worksheets ready to print and use with teacher information as well, interactive quizzes for students
- Chem Team for Chem – material is at high school level, has content and worksheets for each area/unit of study
- To be honest, I can't think of one that is the best. Often, a number of websites give one thing that I can find useful, be it a diagram or explanation, then I will "put it all together" from many sources into a coherent and, I hope, interesting lesson.
- Access Excellence – huge bank of resources, labs, activities, worksheets, saves me a lot of time and gives me new ideas in resources, science updates – exchange of activities

- www.chemistrycoach.com – very extensive – links to any chemical issues, very educational
- www.wikipedia.com – concise, factual information that contains hyperlinks for further research
- Fisherman and Scientists Research Society – Information is easy to access
- www.bbc.co.uk/education/asguru/biology/01cellbiology/index.html
- Ontsc.ctre-school resources
- Bill Nye The Science Guy
- How Stuff Works "Science Channel"
- pbs – nova – very interactive, current topics, videos
- Wikipedia – complet, rapide, facile à utiliser, bien vulgarisé (Wikipedia – complete, fast, easy to use, simplified)
- Gouvernement du Québec – plus complet pour les informations recherchées (Québec Government – more complete for sought out information
- National Geographics, fran ou anglais – Reconnu mondialement, jamais ou si peu de controverse (National Geographics, French or English – World reputed – never or very little controversy_
- Google parce qu'il m'offre le plus de choix (Google because it has more choices)

Credibility Issues

The issue of credibility is very important to science and technology teachers. Many noted that they only go to websites run by organisations they trust – universities, professional journals, other reputable organisations, including provincial and federal government sites.

> Yeah. I usually go to sites that I feel are reputable. So anything that is put out by the United Nations, for example, or the Canadian government, or National Geographic. (Teacher, suburban Toronto)

> I have several journals that I'm comfortable with, reputable professional journals, and those are the ones that I use. I end up at science teachers conferences, and you pick up material there and you recognize names. I am more comfortable with material that I get from them, and that's probably where I end up going the next time I am looking for information. (Teacher, suburban Toronto)

> I think, too, it's who puts the site up. If it's the University of Washington versus Bill's Biology Page…. I just made that up, but the point is if it's out of a university, you tend to

> look upon that as being a little more credible than somebody's first name. (Teacher, urban Halifax)
>
> Well, for me Quebec government, .qc.ca, well-known companies, newspapers, scientific magazines, things that are well-established, well-known. They are recognised other than on the Internet. (Teacher, urban Montreal)
>
> On the Internet, it's the problem of knowing what's good and what's not good. The good information and the bad information. At one point, you go on a site, you don't even know who made this site, and it says, "A student from "secondary level 3" So if you don't know where it comes from… I go to places where I know the information is credible. (Teacher, suburban Montreal)

Several teachers expressed concern that students may not know how to differentiate between credible and non-credible sites without clear advice and instruction.

> You teach the lesson first on the difference between picking up Dose or Metro or 24 Hours and going to a scholarly journal. There are some databases that you can go through where you are more likely to get scholarly, backed up, accredited information rather than on Google generally. (Teacher, urban Toronto)
>
> Dot com, you have to be careful. Each user has a possibility of writing a dot com and if everybody does that, you can put any information in there that's more or less true. As teachers I think we're very sensitive to that. and we're careful. But when we send students on sites, if we don't tell them, they don't know. (Teacher, urban Montreal)

Characteristics of a Poor Website

Teachers also identified some of the characteristics that make a website a poor one for their purposes:

- Too "wordy" or text-heavy, lacking in visuals and animations.
- Ads and pop-ups.
- Poor organisation and design, difficult navigation.
- Too technical, above the level of their students.
- Lack of proper attribution, poor credibility.

To be honest, if it doesn't grab my attention right away, if it's too wordy or the language is just too difficult, then after one or two lines, I'm immediately going back. (Teacher, outside of Halifax District)

Bad site? Department of Education. It is laborious to find provincial exam copies or specs. It is too much. If it takes me any longer then 5 minutes to find it, it's not worth my time. (Teacher, outside of Halifax District)

There are sites that turn you off and some are aggressive because there are all sorts of ads popping up. (Teacher, urban Montreal)

Straight text in that it scrolls on and on and on. And then you have to look for what you need. (Teacher, urban Vancouver)

Horrible spelling, no visuals and no authority. They do not tell you where they have come from. (Teacher, urban Vancouver)

Some of them start out free to use, and you get a whole lesson plan worked around it, and then you find out six months later that you have to pay to use it, which is really frustrating. Or they have changed it completely. (Teacher, urban Vancouver)

What is the worst site you have seen?
• Dept. of Education (Nova Scotia); laborious to find provincial exams • www.cars.fr./cw/dossiers – there are many others I dislike, this is one of many I dislike. They are very busy and complicated to follow. They also have continuous links, never arriving at what you are trying to find. • La Presse (cyberpresse.ca) • Le Devoir – à cause de l'abonnement (Le Devoir because of the subscription) • Pas un, mais des sites individuels sans fondement scientifique, ni de soutien. Souvent des ouïes dire (Not one, but many individual sites with no scientific foundation, no support – often just rumours) • Il n'y en a pas un en particulier, mais les sites qui ne présentent qu'un texte sans images, ni liens externes. (There is not one specific one, but sites that only present text without pictures – no external links)
What makes it the worst?
• Worst are difficult to navigate, don't know where to look for things • Too much straight text/too wordy - need more photos, "movies," interactive

tests/games
- Ones that are hard to see
- Password protected
- Not user friendly
- Too many subgroups – not logical
- Some sites give very mathematical and very technical and dry explanations of things like tides, planetary motion, etc.
- Ones that are disorganized
- Ones that are too busy
- Not concise
- Small print
- Hard to read (colours)
- Poor animation (too simple)
- All text, pictures don't load
- Dead links
- Advertising
- Sites with no attribution….text only
- Ones that are too university science based – too much information that is difficult for my students
- Trop d'information (Too much information)
- Pas capable de trier (Can't do triage)

4.3.2 Frequently Used Sites

In the course of their discussions, teachers mentioned a number of websites that they use frequently, and the reasons for their choice of these websites. From their descriptions of what they like about these sites, and why they continue using them, often year after year, a broader picture emerges of what makes a good Internet resource site for the science and technology educator. Some of the most frequently mentioned reasons for using websites included:

- Availability of interesting activities for students.
- Good use of animations and visual elements.
- Informative and well-written articles.
- New and interesting research or scientific facts.
- Lesson plans and presentation tools for teachers.
- Collections of useful links.
- Materials that are curriculum-appropriate.

My favourite one, because I use it every year, is biologyarizona.edu. It is called the biology project, and the reason I like it so much is because it has excellent activities. Students can just go on that site and I have a worksheet for them to follow. They do an activity; one of them is cariotyping. They match up all the cario types, all the chromosomes, and at the end they have to diagnose what the person has. Down Syndrome is one, and they have Kleinfelter Syndrome. It is also really good. It is the same one every year. Then they also have excellent activities for blood types, too, so I use that. I like it because it has good illustrations, good activities. It is easy to use (Teacher, suburban Vancouver)

Google Earth is fantastic. The other day I was going through Berlin as if I were walking along the streets. I went through the Grand Canyon, which just blew me away. I was down in these crevices. It was remarkable. I was able to go to this site to Berlin, and the Reichstag has been all remade and everything. In '45 when the Russians were invading the city and they were attacking the Parliament Buildings, and the bullet holes are there and you can see them on the website. You can go through all this. (Teacher, urban Toronto)

I went to Mitchell Frog. It's a virtual dissection site, which is a favourite that I knew of on biology. (Teacher, urban Toronto)

I like Scientific American and other magazine sites, like Discover, etc., because they have nice little articles which you can download, and they refer you to other sites. Those are the kinds of things I like. (Teacher, urban Halifax)

I use McGraw-Hill. It's really improved, I've found, in the last couple of years, and it's just basically like your book online. It's a real teacher-friendly site, obviously, because it's written for teachers. (Teacher, urban Halifax)

I use the University of Arizona. They have a lot of good information. Just typing in key words, like type in 'DNA replication,' and you'll start to see trends in the searches and all of a sudden you'll see UA, Arizona, and all these published guys, so you go right there. You'll start to see trends in it. I love Discover, Scientific America, University of Arizona, Penn State. There are a lot of big schools. (Teacher, urban Halifax)

The ones I use most frequently: Access to Excellence, Novis, PDS. [Access to Excellence] has an enormous amount of lesson plans, labs already written out, already done, a lot of visuals that have up-to-date science, just like ask-the-expert type of stuff, and just the

quantity of stuff and how easy it is to find it, and its own search engine. (Teacher, urban Halifax)

PBS.org. It's good, and the videos that they have are incredible, and then they have all these teacher resources to go with them, which are all excellent, and also just animations and pictures. Also, Scientific American I had down. Another one I often refer to is Dr. Farabee's online biology book, because I don't have enough textbooks to give my kids, so I usually tell them, "If you're at home and need to look something up, that's a whole biology textbook online." (Teacher, urban Halifax)

I used one called The Perimeter Institute, which is where I went this summer for clone physics, and they do outreach programs for teachers and it has a section for teachers. (Teacher, urban Halifax)

One of my all-time favourite sites is CBC.ca, and I use archives and I go into Quirks and Quarks constantly and play archives. That's one of my all-time favourite sites because without a doubt, every Saturday when I listen to it, there's something applicable to what we're talking about in biology, whether it's some freakish obscure fact or whatever, but I bookmarked it. It's one of my favourite ones, Quirks and Quarks. (Teacher, urban Halifax)

There's one site called chemistrycoach.com that has everything in the entire universe that you'd need on chemistry because it has hundreds of periodic tables and it is linked to almost every other site. So basically, that's the one I use. I give the kids that one. The other one I use is the McGraw Hill textbook. When I did oceanography, I probably went to the Department of Fisheries, a linked one or a specific one, and I got my information from that. Those are probably the three that I use for education but I'm always on the Internet Googling. (Teacher, outside of Halifax District)

Right now I'm doing cell biology, and my favourite site at this point is the cell biology site. It has animations. My students appreciate seeing something visually, and even more then having it be a visual picture, the animation allows for more comprehensive understanding for that fusion or whatever. So my favourite site is very broad-based. It covers many of the topics that are covered in the cell biology unit for Biology 11 and the site I like. I like the animations. It's fairly easy to manoeuvre around in. (Teacher, outside of Halifax District)

The site that sort of pops in my head is Wikipedia.com. It's a really short, concise site. If I want to go into my detail, good hyperlinks within the text to do that. if I don't, that's great. Really like EBSCO, not only for professional articles that I can get easy access to but also for finding articles that are an appropriate content for my students that I could end up making available or usually making hard copies available as discussions go. (Teacher, outside of Halifax District)

The Bedford Institute of Oceanography, because I know a lot of people that work there and I can go to their sites and find out what they're up to. A lot of guest speakers and see what's going on. Fisherman's and Scientist Research Society. I've had them out to my classroom as well, and they always give me their newsletter plus their emails, and they also give out prizes to the Oceans class. They've also got really good, recent research for their current area, so they're kind of hands-on people, plus they have the website, too. So we use that a lot, and the Department of Fisheries and Oceans for Canada, because they give you lots of stats and we can do graphing and look at different things to see what's up and coming in the agricultural world and what their recent research is. It's very clearly laid out. (Teacher, outside of Halifax District)

I may use the Sable Island website. That's excellent. I have a lesson for it. It has everything – a lot of pictures. But it has everything in segments, like it'll be history. When you get to the site on the right, it would have what you're interested in that you can click on. They would have maybe a slideshow of 50 slides and ten different things, history and shipwrecks and horses. My lesson plan was essentially going through all of those in order answering questions. (Teacher, outside of Halifax District)

La Monde Diplomatic. I started reading it, and then when I saw it was online, I got online and I wanted…. They keep me up-to-date. I like that. They say, "Well, this is new. These are the main headers." (Teacher, urban Montreal)

Kathy Shrope. She has an excellent teacher resource site. She seems to be one that collects. There are a number of people that do this, that collect resources from the web and put them in a useable format. And I think she does it as good as anyone does. And she has been doing this for a long time. (Teacher, urban Vancouver)

Wikipedia. It is a very neat site. It is an open-source encyclopaedia, and it is set up nicely with links. As students are going through it, they can study. We were talking about genetic

production. As you come across a new term there is a link that keeps going to it, and it is updated. So the validity of it, I guess, would be something that is a challenge and be aware of. It is an outstanding site. (Teacher, urban Vancouver)

I use the Botany website at UBC a lot because I have our students do a search for plants and then they can use that to help them figure out what they are looking at, because the textbooks that do that are too expensive, so that is a good way to them. I use the Science Exploratorium, a San Francisco website, and they have a really good online section for kids and connections to actually do a frog dissection online as well. I use Howstuffworks a lot, because sometimes they ask me how a microwave works and I am not sure, so I go and find that out. (Teacher, urban Vancouver)

One I go to for almost everything is Wikipedia. It is just an online encyclopaedia, but I find it is the largest. I use it to find more terminology for things that I need more help with. I guess being a new teacher there are I am not a master in anything by any means. (Teacher, suburban Vancouver)

When I was doing geography last year and student teaching, I used StatsCan a little bit. Now I am trying to stick with the geography. StatsCan was good for population densities and graphs and what not. We would do maybe a lab on Stats Can to introduce it, and then I would let them play around with it. (Teacher, suburban Vancouver)

The B.C.-based chemistry teachers. It is great because it talks about curriculum and not necessarily teaching, and other ideas – about tests, provincial exams that come out – and then also with ideas and resources as well. It is excellent; a lot of the time people just sit on there and read it and read the ideas and once in a while people will pop in if they want. (Teacher, suburban Vancouver)

Physics Davidson. I talked a little bit before about his physics simulations, and he has done quite a bit of work on that. He has posted some resources and links to other things so I use that one. (Teacher, suburban Vancouver)

North Carolina University has a demo room where it gives you ideas for demonstrations in the classroom. They have it written out so that you can produce it in the classroom and they also have a little video that you can play if you don't have access to it, so that one I have used quite a bit to get ideas and stuff like that. (Teacher, suburban Vancouver)

> One called fearofphysics.com, and it is a neat little title, but it has the one…. What I like about it is, I do orbiting satellites around the Earth, and it has a place where you can calculate how fast it needs to go blah, blah, blah, and then you hit enter. Put the numbers in and it sends the satellite into orbit and it shows it so the kids kind of get a kick out of that. (Teacher, suburban Vancouver)

> There is one that I use quite regularly with my junior science level, because I do have this: chemelements.com. They go and research different elements to do periodic tables and stuff. It is a useful project in terms of finding out information about the elements. The information they give is lower-based, so it is very understandable. Then it also has a link that goes onto this one chemical. It is comics, so they can find out how elements are used in different comic strips. (Teacher, suburban Vancouver)

> Vevisimo is a grouping of search engines where students can put in a topic and they can find it and it helps them. I think it helps them clarify their search a little bit easier than just Google. (Teacher, urban Vancouver)

The full list of websites that participants said they currently use in their professional lives as science and technology resources covers a wide range of sites. In addition to various search engines and databases, science and technology teachers frequent sites operated by scientific magazines and journals, government, universities, research institutions, media outlets, and other sources that they respect.

What Internet science and technology sources/resources do you use now?
www.//highered.mcgraw-hill.com
www.cbc.ca/quirks/
http://science.nhmccd.edn/biol/bio1int.htm
www.wikipedia.org/
http://sciconn.mcb.arizona.edu/biology.html
http://www.biologycorne.com/worksheets.php
http://biology.about.com/cs/lessonplans912/
http://www.schoolchem.com/a/pieimag.htm
The Physics Teacher – http://scitation.aip.org/tpt
ChemTeam – http://dbhs.wvusd.k12.ca.us/webdocs/chemteamindex.html
Scientific American – http:www.sciam.com
Photo Electric Effect – http://hyperphysics.phy-astr.gsu.edu/hbase/mod1.html
Physics Online – http://www.ndrs.org/physicsonline

www.thephysicsclassroom.com
dbhs.wvusd.k12.ca.us
www.sfu.ca/chemistry
highschoolace.com
www.csun.edu
wardsci.cdm
www.seismo.unr.edu/rtp/pub/louie/class/100/plate-tectonics.html
Access Excellence – www.accessexcellence.org
Nova/PBS – www.pbs.org/wgbh/nova
Dr. Farabies Online Biology Book –
www.emc.maricopa.edu/faculty/farabce/biobk/biobooktoc.html
Biology Animations – science.nhmccd.edu/b101/bio1int.htm
www.chem4kids
www.media-awareness.ca
sciencespot
www.chemistrycoach.com
www.mcgrawhill.ca
http://hrsbsfaff.ednet.ns.ca/jenning2 - Google (Images)
Ebsco
Bedford Institute of Oceanography
Fishermen and Scientists Research Society
Fisheries and Oceans Canada – www.dfo.gov.ca
www.lessonplanspage.com/science
www.teachers.net/lessons
www.bbc.co.uk/education/asguru/biology/01cellbiology/index.html
Enchanted Learning
www.eric.ed.gov
www.eurekalert.org
www.sparknotes.com
enc.com
newtonon.rap.edu/html/ases
teachspacescience.stsci.edu/education.nasa.gov/home/index.html
Science Daily
Ontario Science Centre
Best4sitesnet
freeenergynews.com
solartaos.com
froggy.lbl.gov/virtual
www.medtropolis.com
www.sfu.ca
www.schoolnet.ca
American Associate Advancement of Science
Discovery.com
Fullerton.edu
Canadian geographic
www.nwsel.org (?) – stills

www.criticalthinking – Teachers' manual – critical thinking community
www.kcmetro.cc.mo.us – critical thinking across the curriculum project
www.cabalamat.org – teaching children to think critically and question authority
www.nrdc.org/globalwarming/qthinice.asp
cbc.ca
Artic Icecap
http://earth observatory.nasa.gov
www.sprol.com
news.bbc.cou/uk/2/hi/science/nature
www.msnbc.com/news
www.peopleandplanet.net
www.999today.com/environment
www.mathleague.com
http://earth observatory.nasa.gov
www.usgs.com
United Nations based sites
Canadian government website/Gouvernement du Canada
How stuff works - www.howstuffworks.com
webclements
puzzlemaker.com
http://micro.magnet.fsu.edu/moviegallery
www.bcscience.com
www.botany.ubc.ca
exploratorium.edu/imaging-station/index.html
www.discovery.ca
Kathy Schrock
One look dictionary
Rubistar
Vivisimo (CIA)
emagazine.com.nicenet
discovery.com (the science channel)
wasa.gov and wasa kids
new scientist.com
emagazine.com
www.virology.net
www.chemmovies.unl.edu
www.scienceman.com
www.nationalgeographic.com
www.chemelements.com
physical/geography.net
bctf.bc.ca/psas/bcssta/geography.shtml
cent.sch43.bc.ca/geo12/menu3.htm
www.statscan.com
www.billrye.com
http://webphysics.davidson.edu
http://demorosur.physics.ncsu.edu/

fearofphysics.com
www.biology.arizona.edu
"the biology project"
BCTF website for exams (province exams)
yahoo
www.radio-canada.ca.t.n./découverte /24/réchauffement – Radio Canada Découverte
www.cité-sciences.fr/netco/planète/réchauffement/planète
monde diplomatique.fr – Monde diplomatique
courrier international
atlas historique.net
src.ca – Radio Canada
Ressources naturelles et faune Québec
Québec sciences
De la planète.org
Sciences et vie
La toile du Québec
Digicom technologies

For some of these sites, participants indicated the specific reason they have for using it on a regular basis. Again, these reasons focus on updating information and finding classroom activities and visuals for use with lectures to engage students or illustrate points of the lecture.

How do you use this site? – specific sites

- USGS – worksheets, visuals
- Howstuffworks – general information
- Webchemcuts – chemistry content
- Puzzlemaker – classroom versus activities
- bc science.com – direct classroom connection
- For worksheets (ChemTeam)
- For research (Phys. Teacher, Scientific American)
- For visuals (Photo Electric Effect)
- Resource – Exams/Questions/New Stuff (Physics Online)
- Chem Team – Tutorial
- High School Hub (Ace) – Learning Resources
- Ward's Natural Science – Activities/Demonstrations with subgroup
- Current information – Scientific American
- Photographs, drawings – plate Tectonics
- Wikipedia for general information and a "guide" to help find additional sites/terminology.
- Use the biology project website for genetics unit.
- How stuff works for technology information.
- Google – just for a broad search.

4.3.3 Approaches to Information Gathering

When looking for information to use in their teaching, most teachers begin with a search engine, usually Google, although some use a variety of different search engines. Some indicated that they have become very adept at advanced searches and developing search expressions that effectively refine their searches.

> I'd go into Google, I'd input in my topic, and I'd manage to get through there very easily. (Teacher, urban Toronto)

> It may be a little topic, but if I just want to know a little bit more about it, I'll type in that topic and see what pops up. But you get one million hits or one million places to go. I might click in the top four or five and just see what's there quickly, and then arrange it in a form that my students may or may not be able to understand or perhaps a way that I can make it more exciting, if I can. (Teacher, urban Halifax)

> I've become extremely skilled at the Internet where I use the quotations, I use the plus sign, I use the minus sign. In Google, I've got a formula there, so I have a big screen filtering out stuff I don't want, and I usually only get two or three pages of stuff that pop up. It's usually the first page, even the first three things on that page, that I really want, and I don't even have to look. (Teacher, urban Halifax)

> Even a credibility issue with the type of search engine that I would use. I'm not a sole 'Googler' anymore. It's biased at a certain level, the way Google works. To try different search engines and take the time to actually scan information and decipher it. Then I say, "Do I trust this?" (Teacher, outside of Halifax District)

> I try to use other research engines, because sometimes it takes away pages on French sites. I'll take Yahoo.FR to get varied sources. (Teacher, urban Montreal)

> I use Google in French. I don't have a preference. I go on the first one that Google lists. Well, it's Google or Yahoo French. Google first. (Teacher, urban Montreal)

> I guess you just choose key words carefully. I just Google. Let us see what pops up and then see if I hit anything. (Teacher, urban Vancouver)

A few, including librarians, also use specialised databases as well as search engines to gather information.

> Because classes book in with me and the topics vary constantly, there is not just one site that I go to. So depending on what the science class comes in with, whether it is different environments, genetic diseases, whatever they might come in with, I usually do a search. Now I use a number of different search engines, depending on what I feel like that day. So I will spend some time just going through finding various things, but as I mentioned before I also like to use various databases because then I do not have to wade through all the commercial sites. And I use a lot of magazines. So each class that books in, each topic that is presented, I kind of tackle it in slightly different ways. (Teacher, urban Vancouver)

> Usually I spend some time before I deal with the classes in doing some searches, and I do use the Internet. And I just use search engines, different ones. I try a number of different ones, and there are some new ones. I am trying to remember now. It is on my links, and I cannot remember right now. But in addition to that, I also like using some of the databases that you pay for on a district wide or provincial basis which give access to magazines and journals. And particularly when it comes to science, a lot of the research is published in scientific journals. So if you do a search there, it gives you a lot of up-to-date information without having to sift through a lot of junk. (Teacher, urban Vancouver)

Teachers also noted that they learn about useful websites through word-of-mouth recommendations from colleagues.

> Yeah, word of mouth. You know, one teacher will say, "Oh, this is a really good site to do an astronomy lesson with your class," and you go there and you do that. I have a really good site that I do a DNA fingerprinting lesson with, and I share it with other biology teachers. Yeah, once you find a good site it is word of mouth. (Teacher, suburban Vancouver)

When teachers were invited to conduct online searches for science information during the group sessions, their observed behaviours confirmed this pattern. Most began with a search engine such as Google and from there moved through links to a range of sites, returning to Google when they wanted "a new lead." A few began with educational or scientific databases.

I found one called 'medtropolis.com' and it had different 3-D live talks, and they were explaining things on the brain, skeleton, heart and digestive tract. Then I was just looking up at www.sfu.ca, and that was on exercise, physiology, and it would be like you said, jumping in a pool and then you just look. That's how we do it. (Teacher, urban Toronto)

I found something really neat, NASA. I went through Google, and then the word NASA came at me and something else. Then I thought, "Okay, I'll have to give that a try." I put in 'science and technology' first. That wasn't working for me. Then just plain 'science,' and then I found some NASA and then I just Googled NASA education. Then I came up with an educational site in NASA, and it had a different bunch of different categories, like NASA for Kids. So I went into NASA for Kids. It looked really good. (Teacher, urban Toronto)

I went to trusty Google and came up with a couple of interesting looking websites, preenergynews.com and solarcows.com, so they're clearly dealing with the southwestern U.S. I was just sort of into investigating the rivers section. I don't know how I got to that. I just go in, Google, and then I'm keying in on things which strike me, and then taking it from there. (Teacher, urban Toronto)

I started with ERIC, Education Research Data Base, and didn't get very far with that. At one point I got to Wikipedia and abandoned it, and then I typed in 'eureka' looking for the TV Ontario Eureka help site. I never made it to there because along the way I found the Journal of the American Association for the Advancement of Science, which is absolutely fascinating technology, marine science and science for kids, bioinformatics, space and planetary. (Teacher, urban Toronto)

Google came up, so I just typed in "how to teach kids to think critically" and about 49,000 sites came up. So the first 3 pages I decided on let me choose a few that looked interesting and I wrote 4 down: one that dealt with skills – critical thinking skills; one that dealt with teachers manual, critical thinking committee – they are the ones with critical thinking across the curriculum project. The last one was teaching children to think critically and question authority. I mean, I would like to have read some of them, but.… (Teacher, suburban Toronto)

4.3.4 Attitudes toward Canadian Resources

Some teachers indicated that Canadian content and Canadian resources are of importance to them. Some indicated that they want to be able to link Canadian examples or Canadian research to their course topics whenever it is possible.

> I said before that Canadian content was important to me. I still maintain that it is, and I think that's terrific. (Teacher, urban Toronto)

> Yes. I mean if you're going to be biased, you might as well be biased Canadian. (Teacher, urban Toronto)

> Depends on the subject matter and how important it is, I think. If I was going to do an arctic glacier or something like that, I would say it would be because the information that they might get – a Canadian scientist, Canadian sources – may be more relevant to what's going on. (Teacher, suburban Toronto)

> There is a perception that Canadians are leading the field in that particular area and that is when you probably want to look further into that. (Teacher, suburban Toronto)

> I think it's important. If you can apply something in biology or physics to something that they had heard about, like cleaning up Halifax Harbour, it can be challenging to try to make it fit your curriculum. That's the challenge. If you were doing Science 10 Ecology, cleaning up Halifax Harbour is a gold mine, but for Grade 12 biology, unless they started talking about contamination of genomes in a green crab on the basin floor and now they've identified…. (Teacher, urban Halifax)

> I'm not saying it has to be on-site, but there has to be science about Canada that's relevant that we can teach. (Teacher, urban Halifax)

> Well I think sometimes when topics are so broad…. For example, in grade 8 they study drugs, and if you want them to do sort of current research…. I mean, having kids in B.C. research drug trends in Asia is not really as relevant as what is going on for them. So for things like that, when they are doing current topics, I like to focus on Canada because it is more relevant to their lives. (Teacher, urban Vancouver)

> There is a Canadian one that I have tapped into. I cannot remember. Web Elements, chemistry then (sounds like, Puzzlement3.com), but BCScience.com. The thing with this is that there is a direct connection with one of the textbooks that I supplement to our grade 10 and there is a lot of stuff there. (Teacher, urban Vancouver)

> I agree with you guys in the fact that Canadian content is important. Most of the stuff I find is American content, and so to get something that is Canadian content and be able to present that in my classroom I think is a positive thing (Teacher, suburban Vancouver)

Some indicated that they select the resource materials they use primarily on the basis of their quality and not on their specific relevance to Canada.

> I don't want them because they're Canadian; I want them because they're legit and useful. (Teacher, urban Toronto)

> The best material is not necessarily the best Canadian material. (Teacher, urban Halifax)

Several teachers reported that they regularly use Government of Canada websites for information, and that they find some of these sites to be excellent resources for specific teaching units. The departmental sites they mentioned included:

- Ministry of Natural Resources
- Parliament
- Statistics Canada
- National Defence
- Veterans Affairs
- Fisheries and Oceans
- Health Canada

Not all teachers find Government of Canada websites useful; in particular, these teachers felt that Government of Canada websites were not known for being valuable resources for teachers.

> I just think teachers might be intimidated by something run by the Government of Canada that they don't know, it is hardly known as a teacher's resource. (Teacher, suburban Vancouver)

Some indicated that they have generally found many Government of Canada sites to be too text-heavy and difficult to search.

Well, I don't want to generalize, but a lot of them are heavy. (Teacher, urban Montreal)

Well, there are always a lot of complicated menus and you never know what to click. You see search, and either they say they haven't found anything or 12,000 in the 10 first ones had nothing to do with it, so you scrap it. (Teacher, suburban Montreal)

They are usually not terribly exciting. You just usually click on a page and then you get a long list, sometimes they are a little bit difficult to find what you are looking for. I have found usually if I am going to direct the kids to it, I find a very specific page that they need, because most of them would not be able to, or have the attention span, to search it out. (Teacher, urban Vancouver)

When you go on a Government site, there's tons of stuff everywhere. It's difficult finding a link with what you're looking for. It's too vast. There's too much. If everything is interlinked, it takes too long. (Teacher, suburban Montreal)

4.4 Current Awareness and Use of Science.gc.ca

Awareness and previous use of the Science.gc.ca website was quite limited; only a few participants had visited the website before. Those who were aware of the site indicated that they had found the site either as a result of an Internet search or because they had heard about it, either through colleagues or through promotional materials made available to them at a conference.

Among those who had visited the website before, perceptions of the site were mixed. A few thought it was a potentially useful site and had used some of the resources available on the site, but others found it difficult to locate the information or kinds of teaching resources they wanted and had not returned to it.

> I think I've been there before, after one of the conferences I was at. They were there promoting the website through some fliers or what not, so I think I've been there before. It's nicely organized. There are a couple of things that I would add to it to streamline the process maybe. (Teacher, suburban Toronto)

> As soon as I go to the website, in the past I don't even look for anything now. I just go right to the search engine on the website and type something in, but inevitably I get link after link and then, "Okay, this looks interesting. Maybe this is what I want," but I cannot get it specific enough. Then I just go right back to the Internet, to Google, and then I do my specific search. (Teacher, urban Halifax)

> I used it once. I was doing something on the genome. I wanted to explain to the students the percentages and I wanted to simulate this with a game. The only site I found that could simulate it was a Government site. But it was too complicated, so I didn't do it. (Teacher, suburban Montreal)

Some had not expected to find resources for teaching secondary school on a federal government website; as elementary and secondary education is under provincial jurisdiction, it did not occur to them to look for specific teaching resources on a federal government website.

> I think it's a question of themes. We did agriculture. I suppose we could have used it, but it's more concentrated on Quebec, and I didn't go. I was surprised when I found this, because I didn't see a link between the Federal Government and teaching. Education and the Federal

> Government, to me, are not linked because it's not their responsibility. I was wondering what they were doing there. (Teacher, suburban Montreal)

When specifically asked about current use, most participants said that they were not currently using Science.gc.ca; the most common reason offered for not using it was that they had not been aware of the existence of the website. A few mentioned particular items on the website that they currently use in their classrooms.

Are you personally using this site for any tasks currently? If yes, what tasks? If no, why not?
• No, because none of my teaching subjects are related to this site. • Non, trop statique, nos jeunes ont besoin que le site soit très dynamique (No, too static, our students need something more energetic) • Viruses in our cells • Search cells – I like the virtual microscope that is there • Yes. Digital radio (Audio Broadcasting).

4.5 Exploring Science.gc.ca

In order to gain feedback on the Science.gc.ca website as a resource for science and technology educators, the participants were invited to explore the website and record their impressions in a variety of areas:

- General impressions, positive and critical.
- Information: content, usefulness and credibility.
- Ways to improve the site's information content and relevance.
- Specific resources that could be made available through the website.
- Response to the website's portal concept.

In interpreting the comments of participants, it should be borne in mind that participants in the group discussions were free to explore the site at will, and could – and often did – end up on a site linked from Science.gc.ca. Not all participants, however, were aware that Science.gc.ca is a portal site, and hence were not always aware that they had left Science.gc.ca. Hence, some of the participants' feedback does not directly refer to Science.gc.ca but to other sites that are linked from Science.gc.ca, including other Government of Canada sites. These comments, however, are included in this report as they serve to underline participants' general preferences and criticisms of Internet resources for educators.

Expectations

In one of the Vancouver groups, technical difficulties prevented participants from accessing the Science.gc.ca website. Instead, participants discussed their expectations of a federal government website intended to be a resource for the teaching of science and technology.

> It would have been great to have specific topics, a link for resources for teachers and a list of worksheets corrected to the BC curriculum. I would like to see worksheets ready to go and sufficient safeguards so that my students cannot go in and access the answers. (Teacher, urban Vancouver)

> I would hope that it would be separated into biology and chemistry and physics so that students can quickly look for the topic that they are studying in class, because that is how we separate their courses as well. (Teacher, urban Vancouver)

I would like to see a lot of the different science topics related to Canada in some way. So for instance, if you are studying genetics, maybe have information of areas in Canada, universities perhaps, where there is research being done on that. (Teacher, urban Vancouver)

I would like to see it organized where there is a concise, brief, sort of outline or summary of the topic built into it with links giving you a bit more in-depth information. The long, long scrolling information sheets students will not use, but if you get something quick and short that is useable with lots of visuals, that would be great. (Teacher, urban Vancouver)

Well, I would go and visit that site, it is Canada and it is science and we will see what is has to offer. (Teacher, urban Vancouver)

4.5.1 Initial Response

After visiting and taking time to explore Science.gc.ca, participants recorded their initial impressions of the website prior to engaging in discussions about their responses and thoughts.

What do you think/feel about the site in general?
Positive responses
• A great deal of information • Neat, interesting facts to share with students but I didn't see a lot that I could use for my students but more for mainstream • Very extensive • Easy to get around, interesting and relevant material • Various fields laid out in easy to read manner – featured links (to Olympics – skeleton team) • Interesting. • Wide base of topics. • Expansive. • Home page colourful, looked interesting. • It was okay. • Good mag. topics. • Materials. • Excellent resource base. • Easy to navigate/easy to move around/good and easy navigation • Well organized. • Very informative. • Up-to-date.

- Professional.
- Reliable.
- Excellent looking site for resources.
- Good to see Canadian content.
- Il est bien structuré, assez facile pour naviguer, traite de plusieurs sujets intéressants. (Well structured – easy to navigate, speaks of many interesting subjects)
- Bon index (Good index)
- Sujets intéressants (Interesting subjects)
- Sites pas lourds à l'œil nu (Sites not too busy at first glance)

Critical Responses

- Difficult to use
- Not enough for chem. or physics
- Not overly useful
- Not user friendly for classrooms
- Ce site renseigne de façon général, ennuyant, présentation qui manque de dynamisme surtout pour les 3 (Informs in a general way, boring, presentation that lacks energy especially for Sec. 3)
- Narrow focus. Breakdown all resources by subject, unit matter, chemistry
- No results for physics research
- Typical government site
- Too much information/frivolity
- Too many navigational bars
- Lack of focus
- Not bad but some areas seem difficult to navigate
- Drag, resistance.
- Very bored
- Un peu plus gai que certains autres sites du gouvernement, par exemple – défense nationale mais encore un peu terne. (A bit livelier than other government sites, for example – National Defence, but still bland)

General Positive Responses

Initial positive responses tended to focus on extensive information, ease of navigation and good organization. Those who liked the website expected that they would be able to easily locate credible information on a wide range of subjects. Some found visuals during their initial search that they felt they could use with their students, and this heightened their appreciation of the site.

> There are lots of categories, and I had a good pick and choose around things, so it was very accessible. I guess when I pulled it up it was more specific, because it had a little list of categories there for me to hit on. I guess if I just to go Google I'm free associating and free

wheeling. This one did have categories – food, climate, energy were in it. I went to a few of those, and things typically led to more categories under food, so I went on from there. It had a whole wealth of possibilities. It was fine. (Teacher, urban Toronto)

It's easy to navigate. There was a lot of information that was put out by the government of Canada, so I know that it's not just somebody putting it out. In terms of just for myself, I want to find information for my class or for lesson plans. There's a lot of good. It's definitely a site I would go to. I will probably use it this week. (Teacher, suburban Toronto)

It's very well organized in the fact that I could branch from one link to another one, looking at food and then just agriculture, GMOs things like that. It's up-to-date, so it looks like there's some information that they've just recently added, and that could link that to previous information, so you can sort of track progress or changes. (Teacher, suburban Toronto)

I like it because I like the broad categories which are subdivided into almost anything that you can possibly want to look for. I'm teaching optics at the moment, so I zeroed in right away into something called synchronic, which is looking at the light, looking at the internal structure of material. So this is something I definitely would tell my kids to go and look at before we actually start. (Teacher, suburban Toronto)

I think right away that the buttons on the one side there…. It led me to click them. I saw all those buttons, I scrolled right down, and I could find what I was looking for quite quickly. I was looking for specific things for my topic, involving physics or astronomy or something like that, and I found astronomy right away, which I teach in Science 9. So I went there and I saw Canadian skies right away, and I thought, "Oh, excellent. Here is something I can use in my science class." (Teacher, suburban Vancouver)

I liked the front page. I thought it was colourful, inviting. I liked the organization under the categories like that little folder format. (Teacher, urban Toronto)

Positive mentions of the Canadian content available on the website were included in some assessments.

> The layout was good. I didn't like that there wasn't really a geography section aside, so I had to click. There was a search that was easy. I just put in "geography" and some stuff came up. It was good that it was Canadian. (Teacher, suburban Vancouver)

Specific Items of Interest

Participants mentioned a number of features they saw on the site that appealed to them in some fashion as items of potential interest or usefulness. Specific items of interest that drew participants' attention included:

- The surveys
- The wind tunnel
- Alpine glaciers
- The Olympics-themed information
- The periodic table

> The best part about it was the very first part where you got to look at the surveys and the results of all the surveys if you voted in…. I think this week's question was how many hours sleep do you get a night, and if you went, then you got to see all the back questions too, and they were very interesting. (Teacher, urban Toronto)

> I liked the "did you know," because I went to volcanoes and they said, "Did you know?" They talked about volcanoes, and what I liked about it as well is that I went to another site that led me to…. I think it is educational resources. I was looking at glaciations and it had Canadian alpine glaciers, so you could go and look at Canadian alpine glaciers. (Teacher, suburban Vancouver)

> It caught my attention, the wind tunnel thing, and then when I looked through it, it had like an Olympic theme. It was timely and topical, because in our ESL class across the corridor…. I got the papers for them, so they're doing almost like a Grade 7/8 unit that I would do with the Olympics for two, three weeks. Something as boring as the skeleton run or the bobsled…. This seemed to talk about aerodynamics and how they tested the suits. Maybe that would give the kids a little more insight, because when I used to do the Olympics with my elementary kids, we were intense for two, three weeks, and we enjoyed that. It would bring a little science. (Teacher, urban Toronto)

> The periodic table was really well done. The chart is there and you can click on an element, and it all comes out with the atomic weight and everything, and they put it into context.

> Often I'll talk about an element and these things are like, "What do you do with this on an everyday basis?" Like copper. You use it for X, Y and Z. I thought that was really well done. (Teacher, suburban Montreal)

General Critical Responses

A number of participants found the Science.gc.ca website to be visually uninspiring. It did not draw them in. One of the most common critical descriptions of the site was that it seemed "boring."

> In comparison to the NASA site I was on…. The term's probably inappropriate, but the NASA one was sexy. There were colours, it was entertaining, and it drew in my attention. I want to get the mouse and go here, go there. This one was boring. Nothing grabbed my attention. (Teacher, urban Toronto)

> Presentation was boring. There were a lot of references, but not very specific references. Too general. (Teacher, urban Montreal)

> Then I went to another site on viruses and it looked more boring than a textbook. It was very boring. Then I went to smoking and health, and it was a whole bunch of Stats Canada. It didn't look that exciting to me. (Teacher, urban Toronto)

Of particular concern to some was that the presentation of the site would not appeal to students, who are accustomed to slick presentation values and a heavy use of graphic elements.

> I think its page design has a lot to do with it. I think that far more students today are used to looking at a whole page and having all sorts of things all over and they deal very well with that, and the pages I was looking at were just as you said – set up like print. I think they want to have interesting subsections that they can explore. I think it needs colour, like the front page. It needs graphs and statistical data presented in interesting ways. (Teacher, urban Toronto)

> My concern is kids are used to really slick production and when they do not see it, they tend to just turn off. I think of government sites and I look at them…. I mean just looking at what was on that page does not grab you. It does not say, "Oh this could be really cool." It is boring. It is a government site, and I do not know if they will use it. (Teacher, urban Vancouver)

A number of participants felt overwhelmed by the extensive information available on and through the website. They reported feeling unsure of how to locate the information they wanted, of getting confused and "lost."

> I found it a little bit overwhelming. If I was going in with a clear purpose in mind to find out information or to find materials, whatever it may be, I didn't know where to go to look for it on that site. It was just too many topics. Do I go to the A to Z? Do I follow Biology? I didn't know where to go, so I spent a lot of time fumbling around trying to find what I was looking for. (Teacher, urban Halifax)

> I found it very cumbersome. There were side banners. There were top banners. There were other ones you could have chosen in the centre. Too much information; need to be more focused on whether I was looking for scientists, or if I was looking for an activity, or if I was looking for information. It's just too cumbersome. (Teacher, urban Halifax)

> I kind of got lost in some spots, and had to sort of get back to where I was. I just found that there was too much information. I was overloaded. (Teacher, urban Halifax)

> First of all I found it very extensive, if not too large. I ended up getting educators, but lost somewhere along the line. I tried to go back to the home base to find educators. I was going to do the search for educators there. Then I went into careers. Then I went to the top. There were too many sections there. Two sections down…. Every time you clicked on one of the food, environment, all of those, you got another ten different sites. Then you got back in the other end. There was another list of 500 different things. (Teacher, outside of Halifax District)

> It's a typical government website. For a lot of reasons, I found it to be an extremely negative experience being there. It was too much for me to be there. There were too many navigation bars. It had a header and a sidebar. I don't like the design. Too much information. Too much frivolous information. Too much 'what's your opinion' poll. Get this here; it'll pitch you here. When I go to a site like that, if I'm looking for information, I don't want to be asked about my opinion, about my information in a sidebar in a poll survey. (Teacher, outside of Halifax District)

Some participants felt frustrated by the difficulty they encountered in finding information. They indicated that they would be unlikely to use the site because of the time it took to locate specific information.

> I just found that a bit too complicated – too much. For me I just found it too much. There was so much to choose from, and I'm the type of person if I'm going to go to the computer I need to find what I'm looking for. I can't spend 10, 20 minutes on it; then I'm just going to get frustrated. I'd rather look at a book. I have the book in front of me and I can always refer to the book. (Teacher, suburban Toronto)

> In terms of finding information, a lot of text. When you are looking for something, as teachers we often don't have a lot of time to sit and read a lot of text. To add something to my favourites personally, I need to take something away from that site and use it and then say, "Okay, this is why I added it." (Teacher, suburban Vancouver)

Criticisms of Specific Items

Several specific items on the website received critical comments from participants. Among these were:

> I didn't actually like the look of the site, to be honest with you. That image, whatever that image is, that brown thing at the background. Was that a piece of spaghetti at the back? Like the big eye that looked at you. The whole page, the actual whatever you call it… (Teacher, outside of Halifax District)

> I was just in environment, and I was disappointed because the first page I hit was an acknowledgement to the Minister. It was a signed letter, and I've never seen that on a website before. From a user point of view it was extraneous. Then the next page again was a very wordy forward to…. I can't remember which site it was, but it was too much preamble. (Teacher, urban Toronto)

> There's the Canadian flag everywhere, and that gets on my nerves! Really, that's what would prevent me from using it. (Teacher, suburban Montreal)

Some participants also did not like the surveys on the home page; they thought elements like this were lacking in professionalism and educational content.

4.5.2 Content and Relevance

Information

Response to the information on the Science.gc.ca website was mixed. Some thought that the information they saw was too advanced and too technical for themselves, let alone their students.

> If you were working on a specific project, the first article on the Health Canada one was something about how plastic goods produced at high temperatures can affect starch in your foods, which is okay if you want to know about it. But you have to be looking for something very specific to want to read those articles, because they're very scholarly, narrow (inaudible) articles. I'd go back to that American Association for the Advancement of Science site, which was far more varied. It's the difference between reading Popular Psychology and psychology journals, and I'm at the popular level in science and technology. I'm not at the high-level technical, and these were technical. (Teacher, urban Toronto)

Others found the information that they examined to be too basic in tone and lacking in hypertext detail, illustration and related activities.

> Just from what I looked at, it didn't have enough illustrations, enough activities just from the little search I did do. It was just too basic. It had just a glossary. (Teacher, suburban Vancouver)

Some found some of the articles and suggested educational content and activities to be out of date; they felt that in order to be useful, the website should be offering new approaches and ideas and provide the most recent in scientific information.

> It doesn't reflect our reality of teachers. I don't think it reflects the reality of teachers in other provinces. I saw some labs – "put a flower in coloured water" – but that's as old as the hills! It would be nice to have some kind of renewal in the ecology. We did that 10 years ago. You think, "Oh my God! This is nothing new!" Our students are a bit further than that. (Teacher, suburban Montreal)

> I read an article there and the last update was 2004. That's dated for science and technology. I'm not saying what's in the article wasn't good, but there were stats that are probably not

> contemporary at all. Other places, it was more recent, but 2004 – that's really dated. (Teacher, suburban Montreal)

Some agreed that the information on the site could be of use, either for themselves or their students.

> I could use it with my students, because I consulted things on health, because I'm interested in that, but I thought it was okay in terms of information. The students could use it to look for information. It was reliable, well-designed. (Teacher, urban Montreal)

> I could take that site as a starting point to build something. The site would be the trigger for the research, but I don't think it could feed the research. (Teacher, urban Montreal)

> There was a lot of up-to-date information that you can link to everyday reality and put the textbook stuff…. Read them an article on, for instance, an oil spill or something like that that's just happened, instead of something that they've learned like the Exxon Valdez, which was years ago – something up-to-date and what they're doing now and how they're cleaning those birds and that. What are the chances of the environment improving with everyday technology? They've got new things that are on the go, biological disbursements and all the rest of it. So there's lots that you could update your stuff with. I think I'd have to dumb it down a little bit in some respects, but yes, I would use that. I thought it was quite good. (Teacher, outside of Halifax District)

Many participants found the information categories on Science.gc.ca useful for teachers, although some offered some criticisms as well.

Are the information categories on Science.gc.ca useful for teachers? If yes, how are they useful? If no, what about them makes them not useful to teachers?
Positive Responses
• Yes. Relevant/current/applicable to curriculum/Canadian content • Useful for home economics, biology, environmental science teachers (and technology teachers) • Excellent. Lots of well laid out articles • Interesting facts • Yes, up-to-date links • Probably, if you are working on these topics. • Categories make sense (logical). • Yes, variety of links from past, present and into future.

- Yes, like the folder approach to subsections.
- Categories looked useful – connected to curriculum.
- I guess that they can be depending what the teachers are looking for.
- Yes, 8 broad categories which are sub-divided.
- Yes, to give students resources on a particular topic (i.e. fisheries, natural energies) or to better inform a lecture.
- Yes! – very informative, easy to navigate, lots of data, lesson plans available
- Yes. Categorized well. Easy to navigate. Format of the links were the same…makes it less confusing. Categories were accurate and detailed inside the links.
- Yes. Quick, easy, relevant.
- Yes. Good categories.
- Les différentes catégories sont bien définies, utiles mais aussi ennuyeux, bien défini, facile d'utilisation, lien pertinent (Various categories are well defined, useful, but boring, well defined, easy to use, relevant links)
- Regroupés par themes, faciles à utiliser avec les hyperliens, résumés (Grouped by theme, easy to use with hyperlinks, summaries)
- Son actuelles et fiables (Current and reliable)

Critical Responses

- Oui mais comme sources de base mais sans jamais les mettre de l'avant car trop ennuyant (Yes, basic but would not suggest outright, too boring)
- Need to be more clear – separated categories that are easy to find
- Yes, but I had to search hard to find the great areas (i.e. image gallery)

Audience

Many participants were unsure of the intended audience for the Science.gc.ca website – teachers, students, or the general public.

> I thought for myself as an educator it would be good to go through and get information, but to put one of my students on there, even somebody that's at a early junior high level – which is high, for one of my students – they'd be just like, "What's this?" And they'd be on those sites, like those little opinion surveys and stuff, and that may distract them from what they're supposed to be doing. So it's just kind of for certain learners and certain teachers. (Teacher, outside of Halifax District)

> I think it's for the general public. Well, it could include students, but they have to be really structured by the teachers. You don't send kids out on this site. They'll get lost. (Teacher, urban Montreal)

> I found it appealing that there was a teacher section, which is great. Perhaps there is something there for teachers, or perhaps there is some kind of a thing you can take your kids to or something, some materials you might be able to download and read back to your class. So, same thing. That is where I clicked, and I went towards first, and I didn't get too much information yet from that, but I was curious about that section. (Teacher, suburban Vancouver)

Many felt that if the material – or some of it – was intended for students, the level should be clearly indicated in a way that was relevant to all provincial curriculum requirements so that teachers would not have to guess if the information was appropriate to the age or grade of their students.

> I thought it was interesting. There was a table of parasites. I have to choose between 6 and 8 and that has nothing to do with Québec. I don't know what "grade 8" is anymore. I have no idea what "grade 8" is. It's not the same teachings that are done in Québec, as in Ontario. I think they have to adapt to Québec's reality. Maybe it works in other provinces, but here things aren't the same. (Teacher, suburban Montreal)

> I am just looking at these, and I am also wondering…. There is no indication here of level, if it is intended for students. If it is intended for students, what level we are talking about? Is this elementary school, or is it secondary, senior or junior? Maybe a bit of a description of what the lesson plans are for, because science and technology are very broad, and when you have lesson plans, there really should be something on here. It says "fun assessments" and "experiment rubrics." If I am a teacher, unless it tells me what level, I might just pass it by, because I might say that I am going to spend a lot of time looking at it and find out it is entry level. I do not need that. (Teacher, urban Vancouver)

It is possible that this confusion over audience is related to the wide range of responses to the quality of information on the site. Without any cues as to the level of difficulty and complexity of any specific items, it is difficult for some to determine whether the information on the website is appropriate to the audience they have in mind.

Usefulness

Opinions on the usefulness of the website varied. Some felt it would be useful to them personally, or that it would make a good general resource for anyone who wanted to keep up-to-date on matters of science.

> I enjoyed using the site. I found that I could find things from the past, the present and even into the future in the news, and I think that that to me would be useful in the classroom or for the students to look into. The fact you had career, exploration and things like this, up-to-date stuff…. I think it touched on different things. I personally would go back and want to go into it more, find out more. (Teacher, urban Toronto)

> Too much information, not at the level that we teach at. I couldn't really find any specific thing for chemistry and physics. The closest I could get to was satellites. That wasn't even talking about gravitational forces or anything. It wasn't relevant for our school. It's nice to know what's going on in the world if you have a science background and you're interested in keeping up with what's going on, but I wouldn't use it for anything to do with preparation. (Teacher, urban Halifax)

Some felt it would be of use to their students. Others did not see a use for the site in actual course planning, preparation, or teaching.

> I think I'll put it on my website. Each teacher has a website, so I think I will put this so it'll become a link for them [students]. (Teacher, suburban Toronto)

> They're too spread out. I would have wanted something tighter. But now I'm being asked if I could use this in my work. My first impression is no, because it's too diversified. The subjects are interesting, but they're not directly linked to the classes I give. I would have to really sit down and really look at it. At first glance it seems very, very broad. I saw this site was well done, but when you want to find an answer to a direct question, you have to really look. It wasn't very easy. (Teacher, urban Montreal)

Another gauge of the participants' assessment of the website's usefulness lies in their responses to the question of what tasks teachers in general – not necessarily themselves – might be using Science.gc.ca for. Their answers highlight both general areas where they see the website as being a potential resource and specific features of the website that they think could be useful.

What are some key tasks that teachers may be doing on Science.gc.ca?

- Building lesson plans/research articles
- Trying to get information (current)
- Looking for information for relevance, side banners
- Looking for information and resources
- Virtual microscope
- Green house calculator
- Information on climate change for weather unit in science 10
- Researching particular topics/biology/astronomy
- Local information re: science
- New information (web page information i.e. links) and updating resources
- Looking at energy efficiency – energy consumption
- Environmental studies
- Technology
- Using animations
- Statistics.
- Career component/career exploration
- Olympic components/Olympic theme – timely, topical
- Up-to-date news on science.
- Looking up/collecting information/activities for class use/assignments.
- Skeleton. Run-science developed a wind tunnel.
- Aerodynamic lab, tested aerodynamic suits.
- Setting up research assignments.
- Ton ten weather stories.
- Finding/searching for lesson plan ideas.
- Interesting facts
- Canadian light source – synchrotron – internal structure of materials.
- Getting updates for particular subjects
- Providing resources for students.
- Looking for maps, graphs, other links.
- A resource for students to use.
- Photos of specific items such as glaciers, etc.
- Locating resources, learning beyond their own knowledge - details on subjects/units.
- Giving students a general subject and asking them to research in depth.
- Hooks – interesting fact (Orbits)
- Using this as a reference.
- Using this site for students to perform research on a topic.
- Préciser une recherche, vulgariser un sujet, voir différents volets d'un nouveaux sujet de façon globale (To get specific info for research, simplify subject matter, see different aspects of a new subject, more globally.)
- Projection de videos (Video projection)
- Recherche pour les élèves et les profs - consultation (Research for teachers and students – consultation)
- Mise à jour des informations pour un cours (Updating information for a course)
- Recherche personnelle de base, le fond sans plus d'une démonstration (Personal research – just the basics)

- Orienter les élèves sur un sujet spécifique (Direct students to a specific subject)
- L'utiliser comme enrichissement dans certaines circonstances (Use as upgrading material in certain situations)
- L'enseignant pourrait se documenter – cibler des sujets pertinents pour les élèves (Teacher could use as document – target relevant subjects for students)

Canadian Content

Many participants were at least somewhat pleased to have access to a Canadian site with content that is relevant to Canadian students. Others – notably in Montreal – found the emphasis on Canadian content to have a tinge of propaganda, and preferred to see links to international sites.

> It is Canadian-based, which is great to see, and all the examples I could see were all Canadian-based, which is great to bring those in as much as possible into your teaching and for references for our students. As far as students using it, that would just be an activity they could do on the side, because there is a lot of these little tidbits of information. But it wasn't very focused; there are a lot of neat ideas, but not for a specific topic. (Teacher, suburban Vancouver)

> I found it very Canadian. Obviously it's a government site, but maybe the hyperlinks could bring us to Canadian universities or even to other universities in the world. It's very Canadian. I have an example here: Preventing Pollution – Canadian successes. I wonder if it's not propaganda, because you know, Canada has just been slapped around recently. It lacks a little bit of credibility, that it's a governmental site. Well, successful Canadian things in pollution, because I don't think our report card is very good these days. We don't even do as well as the Americans, you know. Credibility has to be there. There has to be something. Let's not be afraid of having hyperlinks to other universities in other countries. (Teacher, urban Montreal)

> I like it. It's tough to bring the most relevant research and the most up-to-date information to your classes, because there's just so much of it coming at you and you don't have a lot of time to kind of distil it. So something like this, and this is what I refer to… Some of the websites I do, that is what they're doing for me, and this has a Canadian flavour to it, so that's what I like about it. (Teacher, suburban Toronto)

4.5.3 Credibility

Participants generally believed that the material on the site would be the result of solid academic research and felt more comfortable with government sites than with commercial sites.

> It's good, because there's no commercial interest trying to make money. (Teacher, urban Toronto)

> And you feel that there's a wave of academic research behind it. (Teacher, urban Toronto)

Most agreed that a Government of Canada website would be credible, and they also expected that any partners and any other sites linked to would also be credible. For many, government sources in general were considered to be among the more credible sources of information on the Internet.

> No, that does make a difference to be local and to be Canadian or to be regional or provincial. Those make a difference, and the fact that it's a .gc.ca portal for me anyway and certainly for my students. The assumption I would say would be there is that since it is a government web portal, any partners that would be hyperlinked to lead you to that site would be approved by the government, and a certain greater trust and validity in using a government site as opposed to using some site you'd get off of Google from Kansas. (Teacher, outside of Halifax District)

> I think in general when we talk to students about judging a website for its credibility, we tend to say that university sites and government sites have a higher credibility rate than others. (Teacher, urban Vancouver)

> Government sites are usually very credible. Up-to-date is a whole other issue. I can have credible information from 1986, but it does not apply now. (Teacher, urban Vancouver)

> I think it is positive, because right away instead of having to look through the site and say, "Okay, who has written this site? Is it some kindergarten student in Idaho...?" To me it makes me feel comfortable that it is a valuable site. (Teacher, suburban Vancouver)

4.5.4 Improvements and Enhancements

Information

Participants were concerned when they could not find enough information on their specialties. Some thought that there was not enough material available on physics or on geography. Others felt that the site was too focused on science and not sufficiently informative on technology studies.

> Expand your database to include more physical science, more physics at first glance. (Teacher, outside of Halifax District)

> It says Science.gc.ca, but I get science and technology. Myself, I would prefer those to be two separate entities. If I'm looking for science, I know it's in there, but there's technology and then there's science. (Teacher, outside of Halifax District)

Some felt that the information needed to be more layered, as well as more interactive and visual. A few suggested that the design of the website was missing opportunities in this regard by not making full use of hypertexting to introduce not only more complex information on a given concept, but also to bring in visual or multimedia elements that would engage students more fully.

> The only thing that I didn't like about it was a lot of it where you clicked, the blue highlighted words, I thought it might give you an example or a picture or something, but it was always giving you vocabulary, like it would always go to a glossary. Maybe if the student was using it and they didn't know what "cell" meant and clicked on it, or DNA – what it meant – and I clicked on DNA and it gave me the vocabulary – a glossary, right? – when I wanted to see maybe a diagram or something; something a little bit different…. (Teacher, suburban Vancouver)

Participants also recorded specific suggestions for improvements to the information categories on the website, although some of their comments also addressed aspects of design and navigation.

In what ways could the information categories on Science.gc.ca be improved?
• Different site map • Search engine • Put information on that is useable for students at lower levels • Too large – lost educators don't like image • Be more encompassing of science fields • Perhaps more links to other related subjects – math/social studies/enlisL

- They could be more interesting and popular.
- A bit boring – not sexy enough.
- Eliminate acknowledgements/wordy forwards.
- Graphs?
- Making sure all sites are available.
- Keep a deeper archive on old news topics.
- Finding "home" button.
- Have a category for physical geography and human geography.
- Perhaps emphasize the categories a little more? Some direction to the categories might be useful. If I stumbled across this site, would I know that the information categories were useful or simply "overviews" to basic pages. How do I know they are useful?
- Maybe a bit longer list of specific science and technologies.
- Specifics for physics.
- More categories!
- Peut être intégrer les sous thèmes dans la page d'accueil cela serait plus rapide je crois (Perhaps by integrating sub themes on home page, would be faster I think)
- Je peux vous suggérer des jeunes qui pourraient le vitaliser. Faites des concours pan canadien pour faire interagir les idées du concept (I can suggest the names of a few students who could liven it up – organize contests across Canada to ensure interaction – concept ideas.)
- Les regrouper en catégories disciplinaires, ex. sciences, géographie (Regroup teaching categories – sciences, geography for example)

Organization

Key to successful organization of information for participants was the ability to be able to quickly identify and locate the specific information that would be of use to them. Several participants suggested ways that the overall organization and search functions of the website might be improved to make this more possible.

> If some people want to get to their subject matter right away, and these are broad categories…. For someone that's teaching geography, this site has pulled together a lot of stuff, but it's all kind of spread out under more generic headings. Whereas if I'm a geography teacher, I want to go, "Okay, what do you got for a geography teacher?" and boom. So just divide it up by subject material as well as the way they've got it. Geography teacher, sure, boom. Some of the resources are just categories under headings. (Teacher, suburban Toronto)

> On the very first page there should be a banner or a link right there for science educators specifically, so that you click on it and then you'll be taken to a page which would be subdivided into subjects. Then you click on your subject, and then there will be articles of interest there: videos, graphics, animations, related links to universities and stuff like that. (Teacher, urban Halifax)

> All of the items at the beginning are well-placed, but maybe it would be a good idea to have a window – you ask the question and it really takes you to the right place. Now, you have to follow their way of thinking, the generic words. But sometimes you don't get directly to what you want. If I could write the question, this is what I'm looking for. (Teacher, suburban Montreal)

> If you could have those as headlines, you could go to 'Arctic' on that website, and then you'll have, let's say, the first line of each of what you just said. "Colour-Blindness in Inuits caused by…" I'd click on that right away, because that sounds like an interesting article, but I wouldn't know where to find it on that right now. But if you had, say, those articles, maybe the title, or maybe a one-sentence summary or the first ten words above each article maybe bannered like some of these news groups have, you can click on that. I think people would use that more. (Teacher, urban Halifax)

Some suggested that since curriculum contents and grade suitability vary significantly from province to province, organization of information should take this into account. Some felt that topics should be identified in such a way that anyone could access specific information and know what general level of achievement is necessary to make effective use of each item or grouping of items. Others wanted to be able to specify their province and locate material that is grade-appropriate based on the curriculum in use in that province.

> I was seeing things in a Nova Scotia site. There were things in geography, and it's not adapted to our reform program. It's not going to work. Maybe they should do a Québec section. I don't know if they should go that far. Forget this idea of years, grades. Go by "theme" and suggest activities for different age groups. Now, it's confusing. (Teacher, suburban Montreal)

> Even maybe the different provinces, because every grade level and curriculum is different, so maybe click on a BC corner or something (Teacher, suburban Vancouver)

> Not something "grade 8" and you feel like you're in Manitoba. You have to respect the subject matter, and you develop it and anybody, it doesn't matter where you are, can use it. You could be in France, in Switzerland, or in Canada. Water is water, and we work on it. (Teacher, suburban Montreal)

Design

Most participants' comments on design issues focused on making the site more interesting and inviting to students. Again, the stress was on the inclusion of more visual and multi-media elements, and adding interactive activities for students to engage in.

> I guess make it more user friendly for students with some learning needs – bigger print, less busy, maybe little interactive activities that they could do. Things that they could do, or maybe they could go on a site and they could read it and, "Okay, I understand this." It says "very basic information, to the point" and then he could write down the information himself. (Teacher, outside of Halifax District)

> Kids who are online very often can be literate. But this is not what they're used to on a computer. What they're used to on a computer is MSN, instant messaging or playing video games. (Teacher, outside of Halifax District)

> I think it was there at the way beginning of the Internet and wasn't upgraded. I look at this with my young students. I would give them a challenge to take that site and redo it. It's not up-to-date, not catchy. In classes – never. I could not bring this to class. They would react very negatively. It's too boring. There is nothing interactive. What I look for in a site like that…. I looked at water, because I have a theme on water, to see what they have that I have never seen. But there were was nothing. There were no visuals. Maybe I didn't have time to find it, but at first glance there was nothing. "Let's get active." I clicked on it, and I thought, "Okay, action." It was a rectangle with words, and I thought, that's not what "passion a l'action" means. I expected multimedia. (Teacher, urban Montreal)

> Well, that would add on to this. The site is rich in information, but that information has to be accompanied, in my opinion, by more spectacular things – audio, multimedia, animation, and if we had external links, because students don't like to read a lot. Things have to swing. Contests, videos, fun. It's like for retirees. (Teacher, urban Montreal)

Features

Participants suggested a number of features that could be added that would increase the usefulness of the website for them. Some wanted to be able to easily locate any new information that had been added to the website.

> We would like a 'what's new' section, what's new in the last week or two. (Teacher, urban Halifax)

Several recommendations focused on the need to provide interesting and interactive features to engage students with the website.

> You could also do a web quest type of thing so that they could have something in front of them that they have to go to a particular site on that site thing. You just think, "Okay, go down to the Department of Fisheries and Oceans, and how much aquaculture was caught in 2005?" or something. Just have a series of things that they have to use, because my kids would be on to something else within 10 minutes. If you turned your back, they'd be out of that site and they'd be into their games. (Teacher, outside of Halifax District)

> And students like things like questionnaires. They have to be interactive. Especially for secondary 1. I think these are things that have to be simpler. (Teacher, urban Montreal)

Some thought the introduction of chatrooms or discussion forums, both for students and for teachers, would enhance the usefulness of the website.

> There could even be a link with the different subjects that are taught – pollution – and forums where the students could chat. For example, Kyoto, and why Canada is there. Like a chat room – a pan-Canadian chat room. (Teacher, urban Montreal)

> Some of the websites I have gone to where it is a lot of content or something have links for teachers to post lesson ideas or things that they did or they like. If there is an area even in the corner of something where they said, "Loved this website. Here is what I did with this in science 9" and then you could click on it and say, "Oh, that's a great idea." Just a place where you can get ideas from. "Here is an idea I may want to do tomorrow." (Teacher, suburban Vancouver)

A number of participants wanted to be able to create and save personal profiles that would enable them to receive email updates on areas of interest to them or create personal collections of preferred links from the Science.gc.ca site.

> The only thing that I would like is that if you need it, that was on the website. But I would like it if on the website you could put in…. Let's say they ask you what you are teaching. I am a physical geography teacher, and they could actually send me e-mails on little things. For example, all of a sudden there is something new. There is an updated story on climate change about the Caribou, and they send me it (Teacher, suburban Vancouver)

> If there was something on that site…. Even the Canadian universities have departments that are specialized to what you're teaching. If they could send out what's going on in your backyard right now…. (Teacher, urban Halifax)

> Can it personalize the forum? I mean, I like that idea of this is my role, this is what I want, and this is what I need. Can we have sub-sites or links instead of navigating through it trying? I like that idea. I am Sean; I'm a physics teacher; I am a geography teacher; I am an English teacher – whatever. And if you create your own profile, that means that you would have to go onsite and then you could start creating your own kind of portal from that. Maybe you just let things start. You go through a few links and then there are programs that can kind of decide what things are relevant to what you looked at already and know what you are searching for. It can create this personal site. Then you can do a physics sub section, and biology. And then stuff can become part of a discussion group. Then all of a sudden it is for all the geography teachers across Canada. (Teacher, suburban Vancouver)

Enhancing First Impressions

In their written exercises, participants mentioned a number of potential improvements and enhancements that they thought would make the website more useful and encourage teachers to return to the site. Some of the key ideas included: organizing material based on teaching subject; identifying appropriate grade/age levels for materials, and ensuring that these identifications apply to all provinces and territories; and adding visuals and interactive elements.

What are the best ways to keep teachers coming back to Science.gc.ca?
• What do you teach? (List subjects) • Banner or link for science educators, then subdivided into subjects with articles of

interest, videos, graphics, animations
- Links related to subjects i.e. universities
- Grade levels/basic topics within each grade
- Video/animation/articles/Canadian research – provincial research in the field
- Broken into headlines e.g. what's new?
- Broken into categories (educations, students, ideas)
- Search engine
- Something which can be accessed rapidly, not in a roundabout way
- Links to top universities/institutions which are doing relevant research
- Tie the subject matter to curricular expectations in various provinces.
- Ce site touche de façon très vaste les sujets sciences et technologies. Il aurait avantage à être plus interactif et plus ludique L'image devrait se photographier – rapprocher des images posters et aussi ajouter des hyperliens (This site targets a very vast number of scientific and techno subjects. It would be better if it were more interactive and amusing. The image should be a photograph – more poster like – and add hyper links.)
- Relancer par courriel sur les nouveautés – par un abonnement (Follow up with email about new elements – subscription)
- Leur proposer des activités pédagogiques adaptés au contenu de leur enseignement (Suggest teaching activities adapted to their program content)
- Il doit être attrayant, vivant, interactif, avec des concours, des jeux, des questionnaires (Must be appealing, interactive, with contests, games, questionnaires)
- Proposer des activités pédagogiques, faire des liens directs avec les programmes (Suggest learning activities, create direct links with programs)

4.5.5 Teaching Resources Available through Science.gc.ca

Participants were most likely to mention resources such as assessment tools, lesson plans, assignments and activities, and lab projects as resources that they would want for their own use in preparing classes and labs. However, as several noted, they wanted these to be available as fully developed packages, even though they might not always use the entire package; this way they would have the option of using the tool in its entirety, or adapting it to their own use, whichever was more appropriate under the circumstances.

The other kind of resource they wanted to have access to was visual elements and animations that they could use in class to engage their students or that they could refer their students to for more information delivered in a way that would hold their interest.

I like websites that give me an idea of assessment tools. I don't always use them word for word, but they definitely give me ideas in how I'll make my revert or what I will have set as criteria for my own projects or assignments and whatever. So I found it's up on the computer. Just an assessment tool. I like ideas or I like sites that give me ideas of activities that I may be able to use or incorporate into my own class. They seem to have those. (Teacher, outside of Halifax District)

I expect it certainly to be scientifically reliable data, and it would be nice if it came in lesson plan form. "Here's something to do for your Grade 10 unit on light and heat in Grade 10 Science. It's here. Here are the visuals. Here's the background piece. Here's an experiment they can do. Here's a test that you can give them at the end." All of that kind of thing. (Teacher, urban Toronto)

I think, really, people have said it: something pretty immediately presentable and accessible for me to implement in the classroom by way of an assignment. (Teacher, urban Toronto)

It had the lesson plans and then it also had the teacher's guide to the lesson plans, so they do match them up pretty well. The answers were there, but I don't know if the plans were necessarily relevant.. (Teacher, urban Halifax)

You know, as far as what I would use that for, they have lots of lesson ideas and assessment tools, like in the biology section, which is where I was kind of looking, which is nice. But it also has stuff that is student-based as well – more animations and things that I enjoy. (Teacher, outside of Halifax District)

Labs. I saw an animation on the microscope that was very interesting, something that a student could go and see. (Teacher, suburban Montreal)

30-minute labs, 15-minute activities, something interesting where you go, "Wow! I'm going to do this with my students. They'll have fun, and they'll learn." (Teacher, suburban Montreal)

Participants listed a number of resources – not necessarily limited to ones that they could access online – that they look to for help with their preparation and teaching.

Besides links, what other main types of resources are you looking for to help with your science and technology teaching responsibilities?
• Interactive • Animated diagrams • Websites • Posters • Maps (for social studies) • Learning Channel stuff. • Working models (planets) (hydraulics) • Relevant data sources • Videos – documentaries, information by research personnel • Overheads to present graphic information. • Lesson plans – reproducible printouts – "fun" activities • Short clips of examples. • Online simulations. • Places to go see i.e. field trips. • Videos, pictures, diagrams, more examples (instead of just vocabulary glossary). • Diaporamas (Slide shows) • Photos avec brève description (Photos with brief description) • Schémas spécifiques pour projections (Specific diagrams for projections) • Multi média, liens, jeux, recherches, démonstrations par simulation, graphiques (Multi media, links, games, research, demonstration via simulation, graphs)

4.5.6 Portal Concept

A few participants were familiar with the term "portal" and welcomed the portal approach, and others noted that they already use other sites that are primarily "collections of useful links" along similar lines.

> I like the portal approach. I went to the portal discussion, actually, here a few weeks ago, and it looks like classrooms or schools are going to be doing that in our district 43 – a portal approach, where basically the school is connected and students will use the portal for accessing resources, and it has discussion boards, and it has just basically everything: how the school can be designed around this portal and it is all similar template (Teacher, suburban Vancouver)

> You know what? Some of the sites that I use regularly are like this. They're kind of… Somebody's gone and done the work to collect a bunch of information and useful and relevant sites. The site is nice itself, but really, it's just taking me elsewhere towards the actual information. (Teacher, suburban Toronto)

Some envisioned the portal concept as a specialized search engine; for some, this seemed to be a useful idea, in that it would make their searching easier. Others did not see a need for another "search engine" when they already had Google.

> It's more like a research engine than a teaching tool. At the beginning I looked at the index. It could be a starting point for research, but it can't be the only source of information. (Teacher, urban Montreal)

> I like it myself because to me it's better then using Google. I mean, at least you're into a particular site that can link you to other sites. Like, here's a feature link to the Olympics, and it's up-to-date and so on to get the kids interested. (Teacher, outside of Halifax District)

> I don't know what a "portal" is! I already have Google. It will take me more directly to something else. I don't need another site that will make the task harder for me. (Teacher, suburban Montreal)

In general, the response to the idea of using a portal site was mixed. Some noted with interest the wide range of material available through the Science.gc.ca portal, others seemed somewhat neutral, and others did not appreciate the approach.

> I didn't know the site existed. I had never used that before. It did actually link me to things like Health Canada, which I had used before when I taught Health. DFO was also linked, which I used when I taught Oceanography. So I found it useful that it had lots of links to other things. (Teacher, outside of Halifax District)

> Well, there are many links to other government sites and other government databases. (Teacher, outside of Halifax District)

> I got lost. I clicked "environment/earth," they took me to sites, sites, sites, and I wasn't finding anything. There was a whole list of sites that mean nothing to me. Right away, when

> I click "earth," bring me to a site where there are pictures. Stop having a reference of references. (Teacher, suburban Montreal)

Participants' responses to the written assignment dealing with their response to the portal approach of Science.gc.ca shows some of the confusion that some have over the meaning of the concept and how it is intended to be of use. On the other hand, a number of those who understood the portal approach seemed to think that it was effective.

What are the strengths of the "portal approach" by Science.gc.ca, in terms of usefulness for you as a teacher?
• Information in inline frame maintaining general "look" of site/feels like you're always at home page • Laid out in a pleasing manner • Easy to read • Portal approach is o.k. The presentation and content was boring. • It is well organized to search on a particular subject. • Can find information relative to many different subjects. • Easy to navigate. • No weaknesses. I like the "portal approach." • Lots of information. Potential to be laid out effectively and efficiently. • User friendly – Teacher section. • Forces – bon index, plusieurs domaines, moteur de recherche (Strengths – good index, numerous subjects, research engine) • Force : très scientifique et rigoureux (Strengths : very scientific and rigorous)
What are the weaknesses of the "portal approach" by Science.gc.ca, in terms of usefulness for you as a teacher?
• Not specific to teachers • Very basic information without sources. • Should not mix science and technology – separate • Too many colours and boxes • Too much information on one page (less boxes would be better) • Too much? Too much "searching" for information or unknown – that is, how do I know if this site is useful? • More diagrams/illustrations instead of just glossary of terms. • Facile de s'égarer, facile pour les élèves de se perdre (Easy to get lost, easy for students to get lost) • Faiblesse – les jeunes n'iront jamais voir passons à l'action – ouch ! (Weaknesses – students will never go to "Passons à L'action" Ouch!)

4.6 Teacher's Kits

Participants were given the opportunity to examine the Science.gc.ca teacher's kit to determine whether any of the resources would be of use, and to see if the kits appeared likely to stimulate greater interest in the website.

4.6.1 Attitudes toward Classroom Resource Kits

Most participants expressed general enthusiasm for classroom resource kits from all sources – governments, corporations, publishing companies. Most viewed anything that might help them with their courses or excite their students as something worth trying out.

> It's because I'm always looking for new ways to engage my students, whenever I get my hands on anything. So whenever the opportunity comes, for example to go to conferences or anything to do with teaching physics or teaching science and helping my students to make that connection between what we do in a classroom and what they're going to be exposed to in reality and what's happening around them, that excites me. (Teacher, suburban Toronto)

> I like to get things that I can use on the computer, and posters and anything visual, because most of my students are visual learners. (Teacher, outside of Halifax District)

> Well, I've been to a couple of different social studies, and they have videos or they have binders available of lesson plans and so on. That was the government that put that out. It was Veteran Affairs, actually. (Teacher, outside of Halifax District)

> I use videos as well, videos that I have I have ordered through some sort of catalogue or something like that. (Teacher, suburban Vancouver)

> Sometimes I get pamphlets in the mail or something like that, just saying "Attention science teacher" and I kind of read through it. Others – my librarian is pretty active in getting resources and stuff like that (Teacher, suburban Vancouver)

Only a few said that they tend to ignore complimentary resources.

> I have a full drawer of these CDs, tapes and all sorts of things that come from the government, companies, publishing firms. They often end up in the bottom of a drawer, because the companies boast about themselves. Like paper and pulp will boast about their respect for the environment. (Teacher, urban Montreal)

4.6.2 General Response to Teacher's Kits

Most participants were interested in the Science.gc.ca teacher's kit and thought it could potentially be of use to them. Many indicated that they would like to explore the materials on CD, and some said that if these materials were good, they might look for similar materials or other resources on the Science.gc.ca website. The key interest was in having access to good quality, curriculum-appropriate visual resources for their students and preparation tools for themselves.

> I think it's well done. I think it's got all the things we were saying it needed. It's got visual, it's got audio, it's got different resources, and it has lesson plans. This is presumably a CD or a DVD – I haven't figured that out yet – on clean technologies. I think it looks like it's well put together. (Teacher, urban Toronto)

> I would go to the website if you had an activity, a student activity. Right in here it says that this is a 30 or 40 minute activity. Here are some things, maybe a worksheet, and you do a lesson with your class. That would make me go. I think something like this needs to be in front, something telling me that as a teacher I can use this. This helps, because now I look at this and I go, "This is useful." This site obviously does too, but that is my biggest concern with websites and stuff. In a lab where I use websites all the time, if I don't know what is on it, you don't spend more than 30 seconds on it until you have found what you want. So if you give me directions – great resource for teachers, stuff on energy, science, wind, physics, all that stuff, you name it – then you are more likely to stay on it. (Teacher, suburban Vancouver)

> The teacher has some background work to do first of all, but I'm just looking at it with the chart and it's got all the grades listed above and different topics. I think you could certainly investigate a few things and some things would come up. It looks good. (Teacher, urban Toronto)

I think when I see this lesson plan, the short videos, all of these materials to me look promising. Until I've actually seen it, I can't tell you it's very promising. I look at this and say that somebody has really thought of this, put a really nice package together. I think that based on what I see, it will come together, and I'll be able to make good use of it. The poster…. Our bulletin boards need something visual, and I think it's still useful for that. Some kids will be looking at it, and even if it's not maybe as super exciting as the DVD might be, it does enhance your classroom. (Teacher, urban Toronto)

I think it's good. I think it would generate a little discussion from the kids. It's certainly broad-based. It's got a lot of information here, stuff that's relevant to kids that they're going to be willing to talk about and have some prior knowledge of. (Teacher, suburban Toronto)

I like that there is a lot of multiculturalism shown in this, because I teach in a school that is highly multicultural. Maybe there is more about this on the disc, but this one is very good for that. This is something that I would definitely put in a classroom. It has some basic information about Canada that you would like the kids to know. (Teacher, suburban Toronto)

I would expect that most of what I'd find here, except for the bookmarks and the Atlas Canada…. All the information, the videos and any media that's here I could find on there [the website]. That's what I would expect when I go there. If I wanted to use a video here instead of using this copy, I would expect I could probably go to a web portal, find that, and make a hyperlink from my site. (Teacher, outside of Halifax District)

I like the evaluation and rubrics. I would like to have a look at the lesson plans, the short videos and the atlas of Canada. (Teacher, urban Vancouver)

Well, stuff that I can fit with my curriculum that I am teaching, so maybe some space things, constellations. First Scientist – that one intrigues me. Earth Tones – that would be, I guess, geology, geography? I would like to see more biology. (Teacher, suburban Vancouver)

I can see a lot of use for this, actually, from a librarian's point of view. Posters are useful, particularly if you can combine them with something the students can take away with them, so if they see a poster…. I am not particularly a fan of bookmarks, but a bookmark or a flyer that they can take with them so that they have the information on it from the poster. I like the idea of the videos, particularly because you can use them with the projectors and get the

> whole class involved rather than just half of the students. Not having seen them, I do not know, but I think technologies is something that we do a lot of, so I would be curious to see what is on it. Yes, I am quite interested, actually. (Teacher, urban Vancouver)

Some felt some of the material would be inappropriate for their classrooms, in terms of level or subject. Others felt the kits were too promotional in nature, or too environmentally wasteful.

> It is too generic. I would want something a little bit more that is geography-only for myself instead of just all sciences for my classroom. (Teacher, suburban Vancouver)
>
> I have a feeling it's advertising. (Teacher, suburban Montreal)
>
> I don't know. If it's for the teachers, it's pretty babyish. I'm not going to put a poster in my bedroom to get the information, or in my classroom. I would have never have thought that this was for me. (Teacher, suburban Montreal)
>
> From my environmental-side. We are bombarded! I think it's wasteful. It looks like a convention when we come back with a bagful of junk that we throw away. It's a waste! And when it comes from the Government, with our environment! (Teacher, suburban Montreal)

Teacher's Kits – General Responses
• Video – interesting/really useful. • My students would use the rulers/bookmarks • Poster good (Pop. Dist.). • Clean Technologies – SSII Environmental Issues – Green speak. • Would check out online resources CD and lesson plans CD • Poster and map – may or may not be useful but can decorate room • Videos – if they are good • Bookmarks – could do without • Lesson plans/rubrics CD • Atlas sites looks intriguing • Science voyageur – looks neat, will have to see it • Posters are good if other relevant handouts (for students) are included (e.g. flyers, bookmarks) • Like the lesson plans and videos – use with projectors in classroom • Did you know poster – too much going on, what is the main focus? • Bookmarks – waste of paper, not really useful • Map of Canada – make smaller, individual size needed • Clean technologies – DVD – most useful – would show this to class

- Science Voyageur – not clear what it is actually about
- Lesson Plans – DVD/PC? What is on it? Grade level?
- Tell me what grade level it is appropriate to: intermediate/junior/senior high
- 30 Short Videos - Earth tones? grade level?
- Text…..picture please….. (a persona would be nice)
- Lesson plans and evaluation rubrics

4.6.3 Specific Items of Interest

The CDs of online resources and lesson plans and the DVD of collected videos received the most interest from participants. Some liked the idea that the videos might be good to use with their students; some were eager to investigate the lesson plans. Some were also interested in finding out what kind of websites the Science Voyager CD would take them to.

A number of participants also expressed interest in the population map. The teaching topics poster received mixed responses – some participants liked it; others saw no use for it. The bookmarks did not receive much comment.

CD – Online Resources

> This CD says that it is an abundance of authoritative online resources, so it appears to be a meta tool that you can use, then, to find the websites that you want to go into other subjects. (Teacher, urban Toronto)

> The 'Science Voyager, a tool for finding great science online,' looks interesting. (Teacher, outside of Halifax District)

CD – Lesson plans

> I think I like the CD that talks about lesson plans and assessment tools. (Teacher, outside of Halifax District)

> I like the lesson plans. (Teacher, outside of Halifax District)

> See, I like this one. Lesson plans, evaluation rubrics. This tells me what is on it, and I like that as a first, young teacher (Teacher, suburban Vancouver)

> Evaluation rubrics is a big one too, because that is a big thing, using rubrics, making available students. It is like a buzz word you hear in the teaching area. (Teacher, suburban Vancouver)

> I look at this CD and think, "Sweet, lesson plans on the CD." Why would I check out the website? If it said "sample lesson plans" and then leads you to more lesson plans on the website, and maybe that is what it says on there…. But just looking at the CD, I feel like this is all I need. I do not need the website. (Teacher, urban Vancouver)

Video collection

> I like the idea of these little short things on a topic that you may be talking about on that particular day. You don't have to show a great big long movie. You can just do a little overview of what you're going to be talking about. (Teacher, outside of Halifax District)

> They don't tell us how long it lasts. I'll have to measure it myself. When you have a 50-minute course, and the CD lasts 60 minutes, it's no good. (Teacher, urban Montreal)

> Thirty video cassettes ready to be shown in the classroom – that interests me. If it's useful and practical, I'd go and have a look. (Teacher, suburban Montreal)

> Also the short videos. Sometimes short videos can be very effective. It depends on how short they are. You don't want them 30 seconds, but they can be really effective. But I have to take a closer look (Teacher, suburban Vancouver)

> I would like to see this one called Greenspeak. It does not clearly say what it is about, but my imagination says that it is something about environmental issues. And it looks like there are three major topics, sort of short videos. So there are probably 10 short videos on environmental issues. And if that is the case, I think there are probably two or three I could use in my class. (Teacher, urban Vancouver)

Map/Atlas

> Just this little map here. I have a couple of kids who are slow learners as well as being in ESL, and I work with my ESL partner, and just seeing 200 ethnic origins are here in Canada, they would like whatever this… If it's good, a lesson plan in more detailed information on

Canada's population, they would enjoy this. Whether it's just a day or two, but she's always looking for material because for our ESL class, there is no material. She just creates it on the fly, so she would enjoy this. (Teacher, urban Toronto)

If I had a class set of these it would be perfect. We're doing our population studies. (Teacher, suburban Toronto)

I'd use the map, but it's unfortunate that it's small. (Teacher, suburban Montreal)

First thing I looked at was the poster, the map of Canada with population distribution on it. Very, very useful. Unfortunately, it is difficult to use something like this in classroom situations. It would be posted up. It is not big enough to use in front of the classroom, so the online version of it would be better, because we all have projectors. I have not seen it, but I assume it is in the map sections. And so all of those things, the social studies labs where we are looking at population distribution in Canada and politics and various issues like that. (Teacher, urban Vancouver)

I like the map of Canada. Well, it's nice to have one up-to-date. The population…Yeah, okay. Show the kids what the population is and densities across Canada, and it's rather bright and visual. (Teacher, outside of Halifax District)

Topics Poster

I like this. I've got the teaching poster. It's of interest. It's of different topics on the website. The columns and the rows are different grade levels of factual information. (Teacher, outside of Halifax District)

I wouldn't use it. Where am I supposed to put this? In my class? A poster isn't something that you read. You look at it from afar. We all put posters in the class and the kids don't look at them. (Teacher, suburban Montreal)

Bookmarks/Rulers

I don't know about the rewarding students with a little bookmark thing. I don't know. I think these would end up on the floor quite quickly. (Teacher, outside of Halifax District)

The bookmarks are a little busy, but that tends to be that standard government issue of plenty of text and no people. I am looking for a face on this thing. They make them again in solid text. What is wrong with the fireman, the medical practitioner, David Suzuki, somebody? The text and the words offer all kinds of suggestions, incite curiosity. (Teacher, urban Vancouver)

The rulers. Kids always need rulers; they don't bring their supplies. If this stuff is free, teachers always like free stuff, so anything that is free I will take a look at. (Teacher, suburban Vancouver)

4.7 Increasing Awareness of S&T Resources

Participants offered a number of suggestions for increasing the awareness of S&T resources such as the Science.gc.ca website among science and technology educators. Some talked about spreading awareness by word of mouth, and indicated that this was something they would likely do.

> I would like to take this and show it to the other science teachers in my department. I think it would be a nice idea if the Ministry of Education could organize once a semester some sort of forum where science teachers can get together from different schools and interact with each other, but also have information, current information like this available to them. But I think there's so much to learn from each other and also from the government once a semester, once a year or something where we can get a PD day, take a PD day and say, "Okay, all the science teachers, this is where you are going, so it's a day's work for you." (Teacher, suburban Toronto)

> We all pretty much said our colleagues were our own best resource, so just being here and taking this back and pointing out the website…. All of our teachers have email. That's how we communicate 95 percent of the time. You send them the link, they have a look, and it doesn't take very long. (Teacher, suburban Toronto)

> I would e-mail this link to my science department, because every resource, any resource is worth checking out, and this one has a lot of potential (Teacher, suburban Vancouver)

Others mentioned more formal avenues, such as presentations at conferences and seminars, as appropriate venues for promoting the Science.gc.ca resources.

> We have lots of conferences, and science conferences particularly – science and tech. This would be an ideal place to disseminate that sort of thing. (Teacher, urban Toronto)

> For example at the YG conference, I've seen other groups do it. Let's say you are trying to promote these resources. You have them available there, and there's also the workshop. People want to sign up, and that's how you access some of the teachers from across the province. (Teacher, suburban Toronto)

> The best way, I think, to encourage me to go to the website… Our district just has a district wide conference. They sponsor activities. It would be great to have a representative presenting this material and then showing the stuff on the website at the same time. That would encourage me more than any other way, I think. I might not right away, because there is too much material here. I would use this first and go through this stuff and then maybe….

> But it would take some time. It wouldn't be right away for me personally. (Teacher, suburban Vancouver)

> I think also you need the time to sit down and actually present it. If it is just given to you, you are depending on the luck or the mood you are in or how busy or how swamped they are. If it is a conference, for instance, they have time to make the time to go and listen to it then. (Teacher, suburban Vancouver)

Others suggested presentations to Ministries of Education, Boards of Education, departments of science within schools and professional organizations for science and technology teachers.

> There are departments that have their board meetings. Aside from PD sessions, they do have board meetings, and there is a coordinator at the Board level that's supposed to be passing information down. So if it can go to the boards, to the coordinators, and come down through their meetings, it would get to the teachers. (Teacher, urban Toronto)

> There are associations like the Ontario Association of Physics Teachers, OAPT, and things like that, and biology teachers. It could go through those kinds of provincial organizations as well, plus there are federal organizations. There's PISA and other things that are federal science teachers. (Teacher, urban Toronto)

> One of the programs that is offered in the neighbourhood that I teach in, because it's a very low socioeconomic neighbourhood for a high minority, is a science program on the campus of York University where we pair Grade 11 students with science professors during the summer to do research. They get a co-op credit. They get an honorarium stipend, about $1,500 or $1,000 or something. They're in class one day a week and then they're in their co-op placement in science four days a week. The one day a week in class, or even as part of their other day, they could be working with some materials like this because they do do research and make a presentation at the end as well. U of T runs a similar program where they do research and present to their colleagues at the end, and I think it would be excellent for that. I think it would be excellent for science departments. I think it needs wider exposure and PD and it needs to come through provincial ministries through Boards of Education in some kind of a roll-out to teachers. (Teacher, urban Toronto)

Other recommendations included advertising in professional journals, making information about the resources available to Faculties of Education and placing promotional materials in school and public libraries.

> Professional journals, it could be advertised there. Faculty of Education for new science teachers pre-service, in-service. (Teacher, urban Toronto)

> School libraries or things like that, areas where people are always looking for information. Obviously, I don't think you could advertise this stuff on a subway or something, but a good place where people go to get ideas and stuff, because sometimes government information isn't known to a lot of people. That is what this stuff is, especially if it's a resource for teachers, a library or a public library. (Teacher, suburban Toronto)

What are the best ways to increase awareness of Science.gc.ca among science and technology teachers?
• Send Boards of Education a set to distribute to teachers through science/technical co-ordinators. • Offer P.D. to Boards of Education • Promote materials through Faculties of Education science teachers • Offer free resources (hard copy, manipulatives, etc.) to science and technology teachers. • Provincial science teaching organization. • Avec du matériel complémentaire comme celui ci (with complementary materials like this) • Pour le courriel, présentation aux profs, journée pédagogique ou congrès (For email, presentation to teachers, teachers' day, convention) • Les informer de l'existence et du contenu du site, leur proposer ce qu'ils peuvent en faire (Tell them about the fact that the site exists and its content, suggest what they can do with it) • Démonstration sur place lors d'une journée pédagogique, site interactif et accrocheur, être en lien avec des sources connues, revues, télévision etc. (On-site demonstration or during teachers' day, interactive, catchy site, online with well known sources, magazines, television, etc.) • Leur envoyer un petit memo vantant les avantages d'utiliser ce site pour les profs. Peut être envoyer une personne ressources dans les écoles (Send them a memo boasting of the advantages of using this site for teachers. Perhaps send in a resource person in the school) • Donner une démonstration aux enseignants en sciences et technologie du site (Give a demonstration to teachers of science and technologies) • Montrer les applications du site, les avantages du site, réunions avec les enseignants (Show site applications, advantages of site, meetings with teachers)