

MEASURING SUCCESS: HOW *CENSUS AT SCHOOL* ENGAGES CANADIAN STUDENTS IN ACTIVE LEARNING OUTCOMES

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This paper examines the experiential process of statistical learning involved in Statistics Canada's Census at School project. It profiles students' learning outcomes and the contribution of classroom teachers, pre-service teachers, school boards and senior management of Statistics Canada in the project's success.

NEW EXPECTATIONS FOR STUDENT LEARNING

The Information age demands the teaching and learning of new skills in data management, information processing and problem solving. And, students are expected to use technology to achieve these ends.

There is also a growing need for statistically literate graduates able to interpret, analyze, and challenge statistical claims.

Some countries are debating whether these skills should be taught as part of mathematics or other curriculum. A 2004 Royal Statistical Society survey of the Association of Teachers of Mathematics in the United Kingdom reported that: "*Mathematics occupies a unique position in its being the only form of knowledge that is systematically deductively constructed. Statistics is inductively generated and, as such, sits more comfortably with Science.*"

Canadian curriculum planners, however, include statistics within a more 'democratized' mathematics program in primary and secondary schools. Since 1997, math curriculum from kindergarten to grade 12 has stressed quantitative and numeric literacy as part of its Data Management and Probability strand.

"Students need to be actively involved in each of the steps that comprise statistics, from gathering information to communicating results. Identifying the range or the average of a set of data, constructing simple graphs and reading data points as answers to specific questions are important activities."

—National Council of Teachers of Mathematics, *Curriculum and Evaluation Standards for School Mathematics*

This updated mathematics curriculum opens the door for us at Statistics Canada, the nation's statistical agency, to provide educators with our expertise and training in statistical skills and competencies, which are at the core of our daily activities. We transfer our knowledge through our Education Outreach program, which offers free online learning resources and support to teachers who are developing statistical literacy among youth.

SHOWCASING STUDENT ACTIVE LEARNING OUTCOMES

Statistics Canada is well-known in the education community as a trusted resource. In 2003, teachers turned to Statistics Canada for assistance when faced with a new grade 12 course on the mathematics of data management, which was starting up in Ontario, Canada's most populous province. This course teaches students how to apply actual sampling, modeling and statistical analysis techniques to everyday topics and issues, with 20% of their final mark based on an analytical data project. Statistics Canada, being a primary source of Canadian social and economic data, was able to help provide large quantities of relevant data for student projects. In addition, our educational representatives worked with teachers and students to help demonstrate how to manipulate and make sense of that data. As a result of this direct involvement with students, and in order to promote their learning outcomes after months of creative work, Statistics Canada sponsored a Student Data Analysis Fair.

On Feb. 24, 2004, more than 400 grade 12 students and 25 teachers converged on Statistics Canada's offices in Ottawa. The Student Data Analysis Fair displayed over 30

exemplary projects, each highlighting the following elements: students' reasons for choosing their topic, their hypothesis, the data they used, the results of data modeling, the mathematical relationships and equations describing those relationships, and finally, their conclusions and questions for further analysis. Students chose a variety of topics, including:

- College enrollment vs. employment
- Motor vehicle deaths vs. seatbelt use
- Youth employment vs. youth crime
- Relationships between annual beer production, beer consumption per capita and percentage of male population aged 20 to 24

One notable project showed the relationship between women with full time jobs and the incidence of childbirth in Canada between 1976 and 1999. The student had hypothesized that an increase in women working full time would result in decreasing birth rates, and found this relationship to be confirmed by the data. Her analysis also showed that the baby boom echo could be closely modeled by a parabola.

These impressive analyses by 17-year old students showed how motivated they were. Through their projects, they demonstrated mastery of the required learning outcomes, including the application and understanding of complex data concepts and methods and the use of analytical software and other applied technologies.

For many students, these projects were the first step in thinking about the possibility of future careers as statisticians, economists and analysts.

Stewart Craven, President of the Ontario Association for Mathematics Education said: "Kids don't usually do things that are important to them in math class, but this Data Fair is proof enough that students can work on meaningful projects in class."

Over the last two years, the idea spread and math teachers held data fairs in four other Ontario communities. Many participating students chose to study data taken from the newly established Census at School project, which offered rich databases about student lifestyles in Canada and other countries.

While Census at School data offers a goldmine of insights into the lives of today's youth, its first goal is to help students build statistical skills in math, social sciences and technology.

EXPERIENTIAL LEARNING AT ITS BEST – CENSUSATSCHOOL IN CANADA

Statistics Canada leads the Canadian component of the international Census at School project, a rich learning experience in statistical enquiry and census-taking. Participating students complete an online survey and then analyze their own class results and compare them to data in Canada and other countries.

Statistics Canada began hosting Census at School in 2003, encouraged by Dr. Neville Davies of the Royal Statistical Society in the United Kingdom. Census at School fit nicely into the mandate of Statistics Canada's Education Outreach Program and was made to order for the new math and technology curricula taking hold across Canada.

"Instruction in statistics should focus on the active involvement of students in the entire process: formulating key questions; collecting and organizing data; representing the data using graphs. Students' understanding of Statistics is also enhanced by evaluating others' arguments."

—National Council of Teachers of Mathematics, *Curriculum and Evaluation Standards for School Mathematics*

Census at School not only teaches about statistics but is cross curricular in that it encourages 'critical thinking,' a skill outcome which is embedded into every Canadian school subject. The project's experiential approach also supports the constructivism theory of learning.

"Constructivism usually means encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to

reflect on and talk about what they are doing and how their knowledge is changing."

—Concept to classroom, *What is constructivism?*

Students own what they learn through the Census at School project, which promotes active learning based on their personal questions and explorations.

Census at School is now in its third year of operation in Canada. While teachers have assessed their students' learning outcomes with Census at School, we at Statistics Canada have assessed teacher engagement with the project—and we give it top marks!

TEACHER INVOLVEMENT WITH CENSUSATSCHOOL

Statistics Canada started with the conviction that teachers had to be involved in the development of the Census at School project from the outset. This resulted in the creation of a Teacher Advisory Board made up of representatives from all regions of Canada. They developed the fundamental infrastructure of the project and helped formulate questions for the online survey, provided an insider perspective on curriculum and created lesson plans that could easily be integrated into classroom teaching. Members of this Teacher Advisory Board had a sense of ownership and felt responsible for the success of the project. They promoted it to their peers at conferences and professional development days, helping to build a community of interest of more than 900 participating teachers who now receive ongoing e-mail communications through Statistics Canada's bi-monthly Learning Resources listserv.

Several members of the Teacher Advisory Board also work in Faculties of Education, where they instruct their pre-service classes on how to use Census at School for real world learning.

PRE-SERVICE TEACHERS PROMOTING CENSUSATSCHOOL

Our six regional education representatives visit most of the 60 Faculties of Education in Canada each year to introduce pre-service teachers (or teachers-in-training) to Census at School. Some faculties require their teachers-in-training to do a five week internship with an education-related business or government organization, in addition to their in-class practicum. Many of these students have asked to do their internship with Statistics Canada, to get better familiarized with the Census at School project. In April and May this year, we received about 20 teacher interns for five weeks, who offered in-class workshops on Census at School in local schools in Toronto and Ottawa. These teacher interns were exposed to new curriculum, technology and the working environment in different schools, and to student reactions to using Census at School. They also took advantage of the data management expertise and the workplace learning opportunities available at Statistics Canada. As they continue in their future careers, these teachers will act as ambassadors for the Census at School project and be better informed advocates of survey skills.

Other pre-service teachers were motivated to create lesson plans using Census at School. A Queens University pre-service teacher recently developed and sent us a Grade 9 math lesson that was modeled after the popular television series 'Crime Scene Investigation (CSI).' In the lesson scenario, a hand print is left at the scene of an auto theft and students are told to compare its size to a sample of hand span data from Census at School. They create a scatter graph, determine the line of best fit, perform a linear regression using a graphing calculator and then interpret the results to find the estimated height of the perpetrator. Students relate to this innovative lesson that involves them in active learning and is fun and trendy too! They become critically thinking detectives who solve a crime investigation by using applied data concepts.

This lesson was also entered into the competition for this year's *Statistics Canada Prize for Curriculum Studies*. Each year, in conjunction with the Canadian Association for Curriculum Studies (CACS), \$500 is awarded to a postsecondary student who creates a lesson using resources from the Statistics Canada website. In 2005, Jessica Redmond, a student from Nipissing University's Faculty of Education, won the prize for her lesson 'Census at School: A Grade Five Introduction to Data Management.'

SCHOOL BOARD SUPPORT OF CENSUS AT SCHOOL

Because of its integration of technology, its development of critical thinking skills and its cross curricular nature, the Census at School project is quickly getting endorsed by school boards across Canada, particularly in Ontario. Within the short two-year period since its inception, the project gained unprecedented support at a grassroots level:

- Census at School is now included in Ontario's math curriculum for grades 6 to 8, which is implemented at the school board level.
- The recently published 2005 textbook *'Math Makes Sense 8'* highlights three pages of examples from Census at School.

"You can also find data about students in other countries that use Census at School. Your teacher can register your class, so you, too, can complete the survey and access data."

—Brown, T. and Featherstone, C. et al., *Math Makes Sense 8*

Both English school boards in Ottawa have embraced the project and are planning teacher training during the spring of 2006. The public school board is offering a half day of professional development training, releasing all 95 of its intermediate (grade 7 and 8) teachers. Their intent is to encourage full implementation of the Census at School project in their 16 schools, reaching almost 8,000 students in these grades.

For its part, the catholic school board's curriculum experts are organizing a "lesson study" on Census at School. The process for this type of innovative study, which originated in Japan, involves a group of teachers who jointly create a series of lessons, by testing, analyzing and refining them in actual classrooms. Student learning outcomes are measured before and after the lesson study and participating students and teachers are interviewed on video.

"Lesson study is widely credited for the steady improvement of Japanese elementary mathematics and science instruction."

—Freidken, Shelley, Lesson Study Group at Mills College, *What is Lesson Study?*

By choosing Census at School as the subject of a lesson study, the school board demonstrates its support for the project through the contribution of human and financial resources. The teachers not only create classroom lessons that bring to life both subject-specific and long-term learning goals for students, but they also evaluate how students respond to these lessons. The video report of the lesson study highlights the students' learning, their engagement and their treatment of one another.

BUY-IN FROM STATISTICS CANADA MANAGERS

As Statistics Canada was the first statistical agency in the world to host the Census at School project on its web site, we needed to work hard to dispel any misconceptions about the project among our own statisticians. While Statistics Canada was launching the Canadian component of the international Census at School project, it was imperative that our senior management and the public understand that it was not an official Statistics Canada survey and that its results would not be used for formal research purposes. All due diligence was followed for methodology, survey process and privacy and confidentiality. In the end, senior managers supported the concept that we were helping to develop 'little statisticians' among students. We would be showing grade school students how to walk through the steps of a survey from start to finish. And, for the first time we could effectively measure how many students were participating in one of our learning activities. With Census at School, Statistics Canada moved effortlessly into the domain of online surveys for kids. This modeled the online option that Statistics Canada is implementing with many of its official surveys, including the 2006 Census.

This year being our census year in Canada, there was added impetus for Statistics Canada to promote the Census at School project. In the months leading up to National Census Day on May 16, 2006, Statistics Canada is hiring 10 part-time resource teachers across the country to teach about the census and to help kids participate in Census at School. These resource teachers

or ‘champions’ support classroom teaching while also spreading the census message to students. It is hoped that students, particularly in areas with a high immigrant population, will bring the important census message home and encourage their parents to count themselves in.

CENSUSAT SCHOOL’S SUCCESS WITH STUDENTS

For the most part, teachers are amazed at what their students can achieve with Census at School results. In a grade 8 class in Edmonton, Alberta, students were so excited about manipulating their data results with pivot charts that they were dragging their poor teacher every which way, showing her their graphs on topics such as:

- TV watching and reading
- homework and gender (girls spend more time on homework)
- Internet access by age and gender
- allergies and pets

Students really respond to their own data and understand the need for accuracy when collecting data. Here’s what some teachers have told us:

“My students got more out of this project than any text book or teacher could communicate.”

“We worked on measurement, data management, graphic displays of data, estimating, and different ways of recording data. It’s a lot more fun to use data of a personal nature.”

Positive comments like these from teachers who have used the project for active learning in the classroom are the ultimate measure of success for Census at School in Canada.

CONCLUSION

CensusAtSchool is a success in Canada. The widespread support of the project by math and social studies teachers, pre-service teachers, school boards and Statistics Canada managers demonstrates its relevance to emerging information needs and skills development. Increasing Canadian student participation and the growing resource bank of projects and lessons received from teachers heralds a robust and positive future.

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