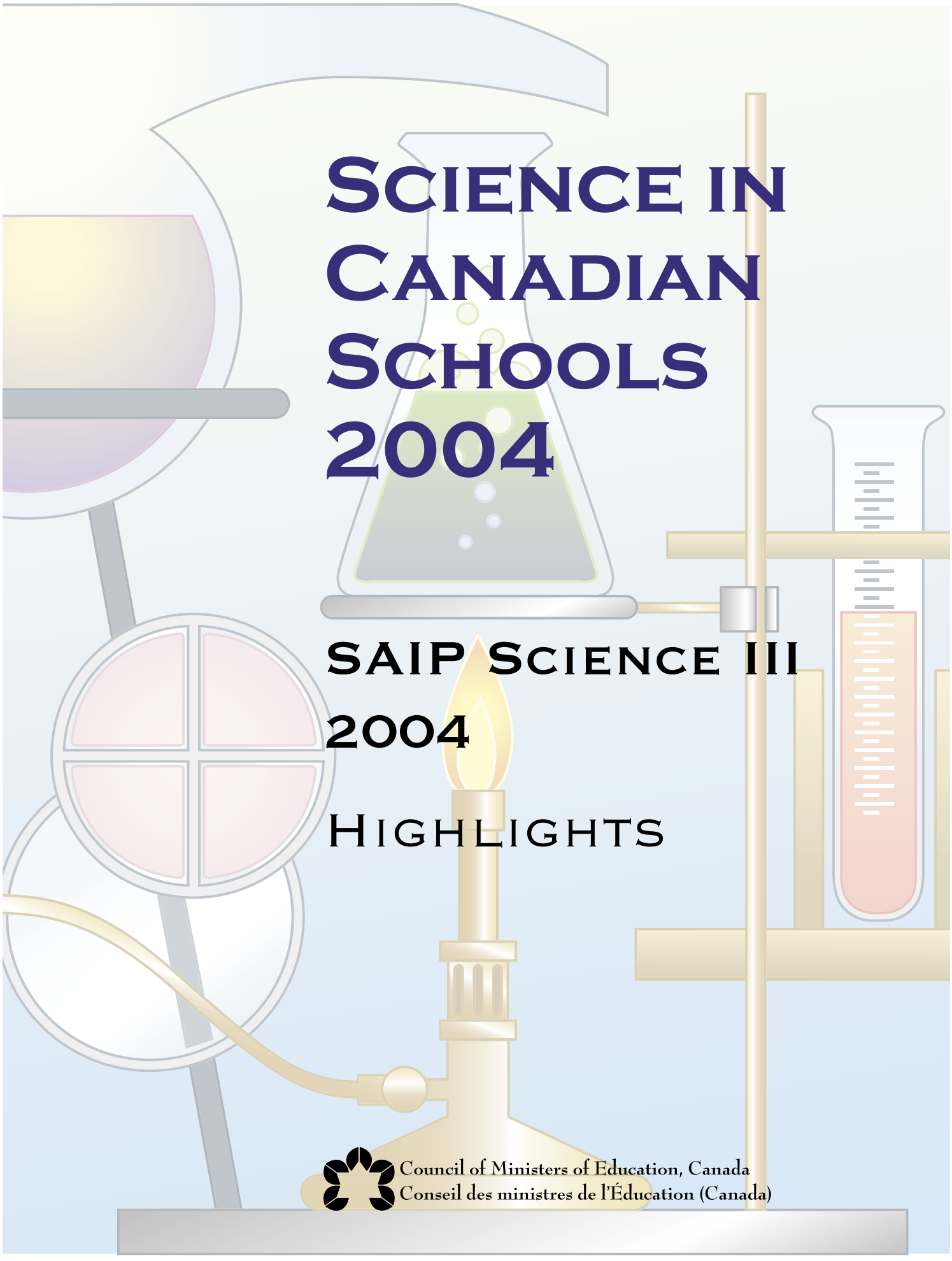
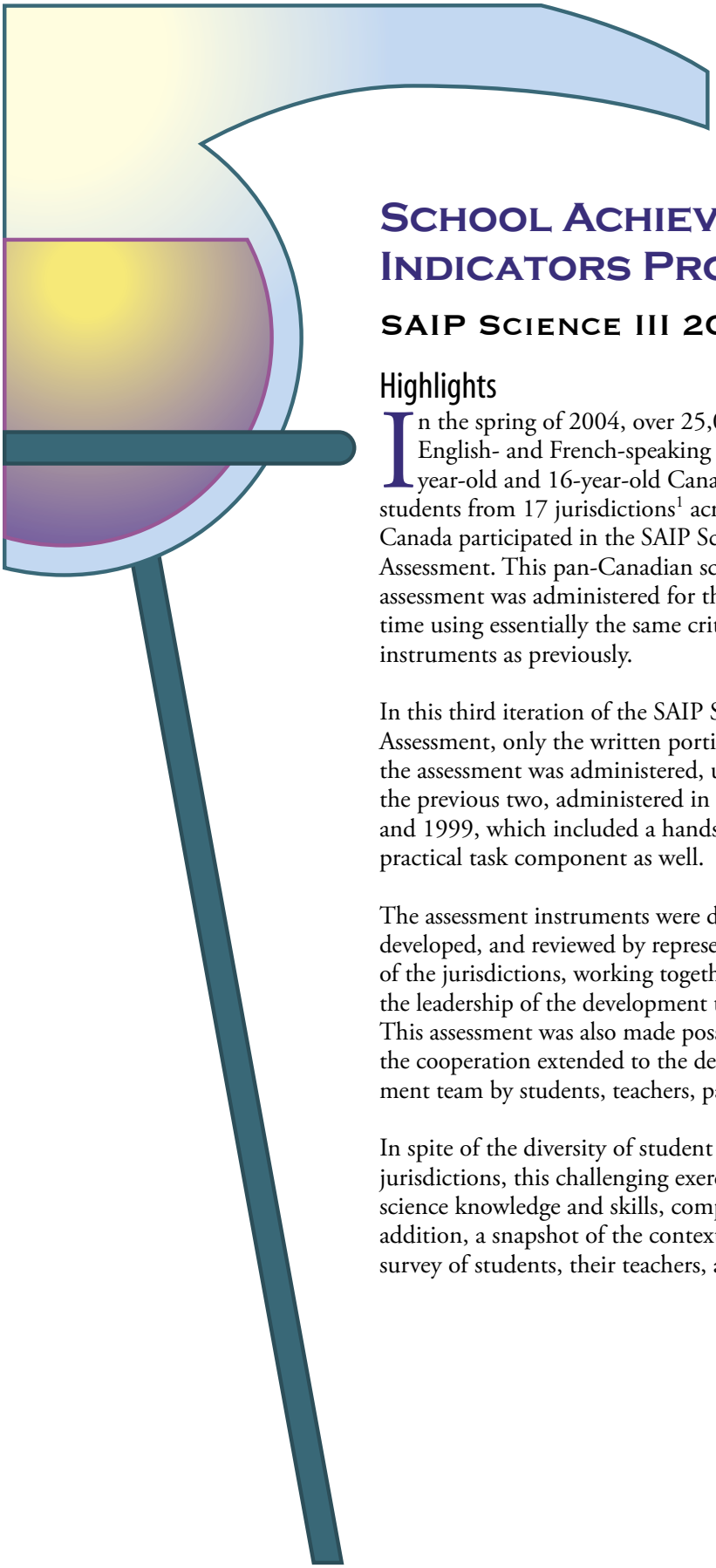


Science in Canadian Schools 2004

SAIP Science III 2004

Highlights

Council of Ministers of Education, Canada
Conseil des ministres de l'Éducation (Canada)



School Achievement Indicators Program

SAIP Science III 2004

Highlights

In the spring of 2004, over 25,000 English- and French-speaking 13-year-old and 16-year-old Canadian students from 17 jurisdictions[1] across Canada participated in the SAIP Science III Assessment. This pan-Canadian science assessment was administered for the third time using essentially the same criteria and instruments as previously.

In this third iteration of the SAIP Science Assessment, only the written portion of the assessment was administered, unlike the previous two, administered in 1996 and 1999, which included a hands-on practical task component as well.

The assessment instruments were designed, developed, and reviewed by representatives of the jurisdictions, working together under the leadership of the development team. This assessment was also made possible by the cooperation extended to the development team by students, teachers, parents, and stakeholder representatives.

In spite of the diversity of student circumstances and educational experiences in the jurisdictions, this challenging exercise produced a comprehensive assessment of student science knowledge and skills, composed for a specific purpose in a specific context. In addition, a snapshot of the context in which students learn science was taken, through a survey of students, their teachers, and their schools.

What is SAIP?

The **School Achievement Indicators Program** was conceived in 1989 by members of the Council of Ministers of Education, Canada (CMEC) as a program of pan-Canadian assessments of student performance in core subjects. SAIP assessments are administered on a cyclical basis to measure student achievement over time in mathematics, reading and writing, and science.

In addition, data are collected on the context in which students learn, through questionnaires completed by students, their teachers, and their school principals.

The information collected through the SAIP assessments is used by each jurisdiction to orient educational priorities and plan program improvements.

[1] All ten provinces, including five with both anglophone and francophone populations, as well as two territories (Yukon and Northwest Territories).

SAIP SCIENCE FRAMEWORK

Separate strands (or domains) were defined as organizers for the SAIP assessment of science.

Knowledge and Concepts of Science
- Chemistry
- Biology
- Physics
- Earth and Space Sciences

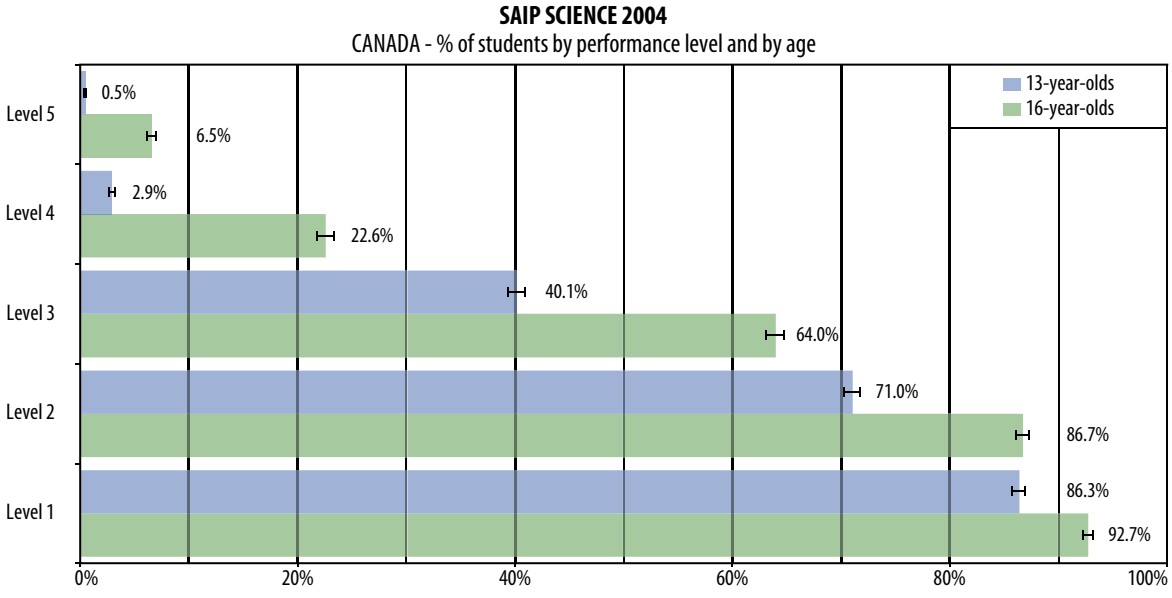
The Nature of Science
- Science, Technology, and the Environment
- Science, Technology, and Society

Sets of criteria (and separate assessment tools) were developed to assess both the knowledge and the skill components within the strands.

Questions within these domains were designed to assess the students'
- conceptual knowledge and understanding
- procedural knowledge and skills
- ability to use science to solve problems

Student achievement is measured using a five-level curriculum framework that represents a continuum of knowledge and skills acquired over the span of the students' elementary and secondary school experiences. The same assessment is administered to both 13-year-olds and 16-year-olds with the expectation that most 13-year-olds would perform at level 2 or better and most 16-year-olds at level 3 or better.

Most students reached expected levels of achievement



Over 70% of 13-year-olds did reach level 2 or above, while 64% of 16-year-olds reached level 3 or above. Notably, more than 40% of the younger students also reached level 3 or above, while more than 20% of older students performed at levels 4 or 5.

To be assigned a level 3, the student can typically

- use chemical properties to compare and classify substances
- know that some life forms are unicellular and others are multicellular, and that life forms are involved in the transfer of energy
- compare gravitational and electrical forces
- compare distances from Earth to the Moon, Sun, and other stars
- analyze experiments and judge their validity
- identify areas where science knowledge and technologies address societal problems

At this level, the student is beginning to integrate principles learned in a variety of earlier science experiences and apply this understanding to a wide variety of real-world situations.

Public expectations met at most levels

In 2004, a pan-Canadian panel of representatives of various sectors of society determined a set of expectations to help interpret the results actually achieved by the students.

The 13-year-old students met the expectations of the panel at levels 1, 2, and 3, while significantly more students were expected to reach levels 4 and 5. Panellists were satisfied with the performance of 16-year-old students at levels 2, 3, 4, and 5. At level 1, there was a small but significant difference that indicates that expectations only slightly exceeded performance.

SAIP results compare well with international assessments

There is consistency of SAIP science results for those jurisdictions where students completed both this SAIP Science III assessment in 2004 and the most recent Programme for International Student Assessment (PISA) science in 2003. More specifically, when we compare the proportion of 16-year-old students achieving at least level 3 in SAIP in each jurisdiction with the overall mean in science for 15-year-olds in PISA, the pattern of relative stronger and weaker performance is very similar.

Also, the low performance of students in French-minority-language settings in SAIP, as exemplified by the high proportion of students achieving level 1 or below, is very consistent with the overall pattern noted in PISA 2003 science, where results from French-minority-language students in French-language school systems were statistically lower than results from students in English-language school systems.

Consistency over time

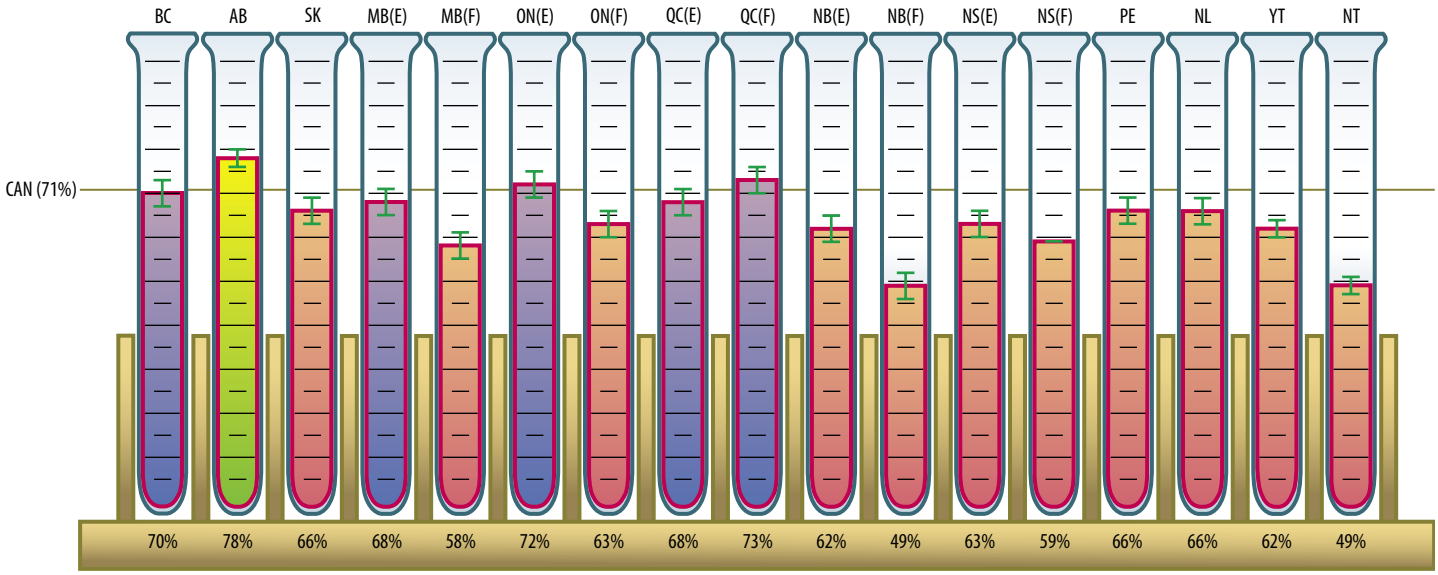
The following chart illustrates results over time, using the standards expected by the design team of level 2 or above for most 13-year-olds and level 3 or above for most 16-year-olds. While the results for both age groups show relative consistency or improvement over time, the results for 16-year-olds in 2004 show a decrease since 1999.

Canada Results	**1996**		**1999**		**2004**
	Written	*Practical Task*	*Written*	*Practical Task*	*Written*
Percentage of 13-year-olds achieving level 2 or higher	71.9 (0.8)	92.8 (0.7)	73.3 (0.8)	90.0 (1.0)	71.0 (0.8)
Percentage of 16-year-olds achieving level 3 or higher	69.0 (0.8)	64.6 (1.2)	76.1 (0.8)	75.7 (1.4)	64.0 (0.9)

The confidence intervals (± 1.96 times the standard errors) for the percentages are shown between parentheses.

Jurisdictional Results in Science in Relation to the Canadian Results

Proportion of 13-year-old students achieving level 2 or better in Canadian provinces and territories



Jurisdictions performing better than the Canadian average

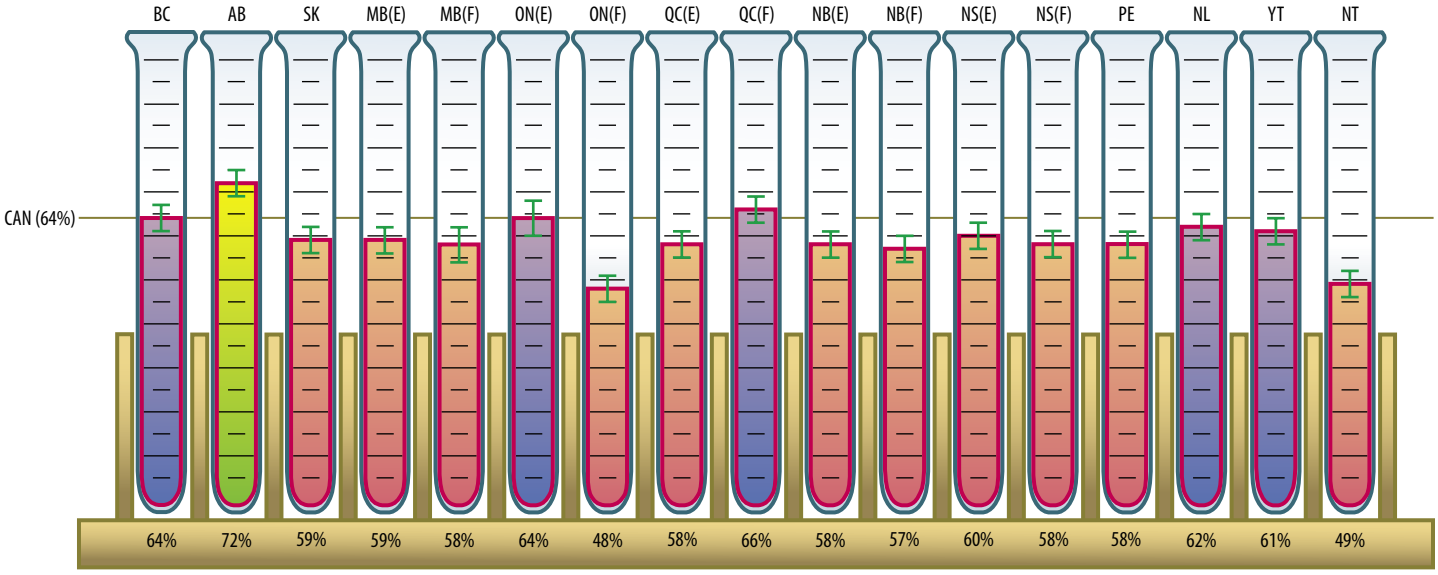
Jurisdictions performing about the same as the Canadian average

Jurisdictions performing lower than the Canadian average

Jurisdictional results are statistically different from Canada if the confidence interval (represented by I) does not overlap with the horizontal line showing results for Canada.

Jurisdictional Results in Science in Relation to the Canadian Results

Proportion of 16-year-old students achieving level 3 or better in Canadian provinces and territories



Jurisdictions performing better than the Canadian average

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Jurisdictions performing lower than the Canadian average

Jurisdictional results are statistically different from Canada if the confidence interval (represented by I) does not overlap with the horizontal line showing results for Canada.

Jurisdictional results consistent with earlier assessments

The data provide a useful picture of Canada as a whole, as well as how students achieved in each participating jurisdiction. While it is not the purpose of the public report to comment on individual jurisdictional trends, it is worth noting that, in general, the achievement trends among jurisdictions have remained consistent from one SAIP assessment to the next. Individual jurisdictions may release reports describing and discussing more fully their own results of this assessment.

Gender gap continues to close

Happily, the gender differences in achievement that had caused such understandable concern in science education for many years have almost disappeared. The professional conferences and curriculum reviews at the jurisdictional level that have been organized specifically to address the issue seem to have had significant impact.

Results for this assessment show that there is no significant difference in achievement between males and females at most levels. The overall message given by these data suggests that the efforts to make science education more relevant to, and more inclusive of, young women continue to have a positive influence on science achievement. Again, the same trend is noted on an international level in the report of PISA 2003 Science.

Language differences cause some concerns

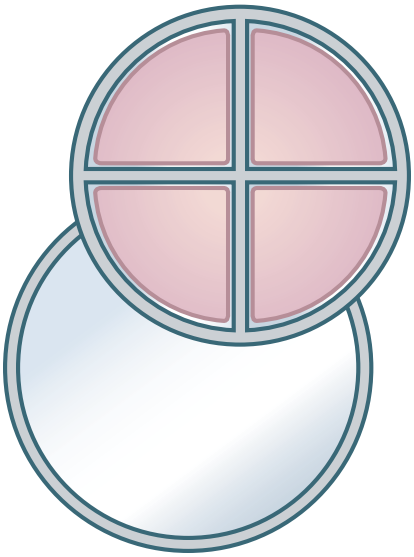
As has been observed in past SAIP assessments, while francophone students within Quebec achieve very well when compared to pan-Canadian results, this is not generally true for francophone students in minority populations. The difficulties encountered by students studying and responding in a language different from that in which they live, work, and play can also be seen in those jurisdictions with a high proportion of students whose first language is neither English nor French.

Below level 1 achievement

The proportion of students not achieving level 1 is about 30% in several jurisdictions. This is a serious concern that needs to be looked into further, as the results show that a significant number of students may not possess a very basic level of science knowledge and skills.

Context in which science is learned

SAIP has attempted to describe the context in which science is learned. Extensive data from questionnaires completed by students, their teachers, and their school principals allowed a picture to be developed of the environment in which students learn in all 17 jurisdictions.



While the qualitative descriptions of the learning context as provided by students, their teachers, and their schools are indeed interesting, actual statistical correlations between these factors and student achievement were more difficult to attain. The complex relationship between student achievement and the many variables that have an impact on teaching and learning was considered by describing a few correlations between student achievement and context that were found to be generally consistent across most jurisdictions. Further analysis of these data needs to be undertaken to take full advantage of the information gathered here.

Some interesting information gathered —

From students

- About 40% of 16-year-olds expect to work eventually in a science- or technology-related field.
- More than 90% of students report access to a computer at home.
- Almost 50% of 13-year-olds and nearly 60% of 16-year-olds agree that science is more difficult than other subjects.
- Nearly 60% of all students reported that they enjoy going to school.

From their teachers

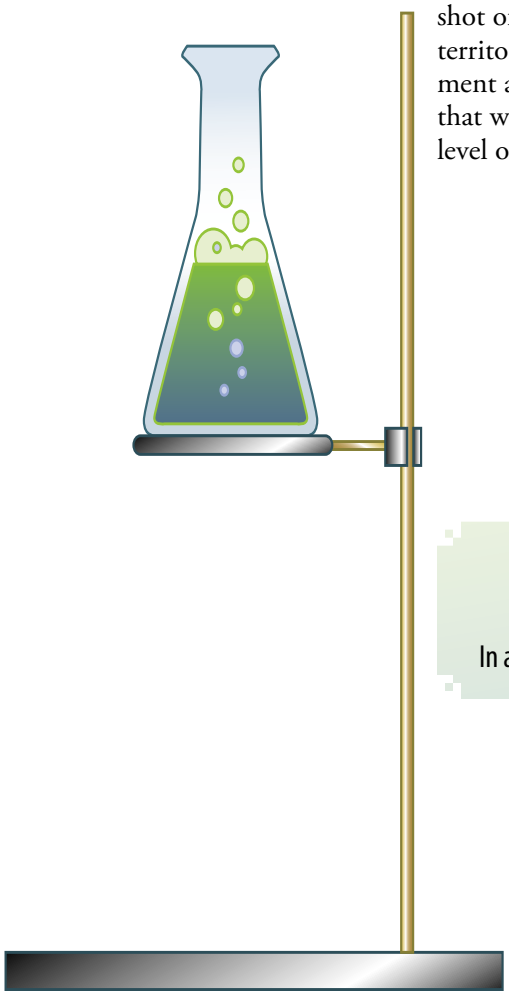
- Most teachers agree that their students appreciate their work but are less confident that society in general appreciates it.
- The average class size is about 25 in most jurisdictions.
- The median age of science teachers is relatively low, reflecting the retirement of many teachers of long experience.

From their school principals

- Classes for 16-year-olds are more likely to be taught by specialized teachers.
- The range of student abilities is often cited as a limitation on the capacity to provide instruction.
- More than 90% of schools report high staff morale.

In closing

In these early years of the 21st century, there are few who would question the importance of ensuring that students acquire a level of scientific literacy and understanding to enable them to function with comfort and competence in the world in which they live, work, and play. Once again, the SAIP Science Assessment has provided a valuable snapshot of the degree to which this has taken place in Canada and within its provinces and territories. Jurisdictions will be able to use the information gathered from this assessment and its predecessors to help them make decisions about curriculum and resources that will provide the best opportunities possible for students to acquire this necessary level of scientific knowledge and skills.



Further results are available in the public report: *SAIP SCIENCE III (2004)*.
This report is available without charge on the CMEC Web site at www.cmec.ca/saip.

In addition, detailed data analysis will be available in a technical report to be produced in 2005.