

The Semestered Secondary School and Student Achievement: Results from the Second Ontario International Science Study

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In an earlier article (Raphael, Wahlstrom, & McLean, 1986), achievement results from the Ontario component of the Second International Mathematics Study (SIMS) were examined in relation to the claims of advocates of the semestered secondary school. While teachers in semestered Ontario schools reported greater variety in their teaching approaches, fewer hours of course instruction were reported. Analyses revealed that students enrolled in semestered Grade 12 and 13 mathematics classes demonstrated significantly lower achievement than their non-semestered school peers with no difference in attitudes.

Ontario also participated in the Second International Science Study (SISS).² Biology, chemistry, and physics classes were sampled from 75 secondary schools, and students were administered achievement and attitude items near the end of their course. Test booklets designed for the three science content areas of biology, chemistry, and physics each consisted of 30 international and 5 Canadian-designed items. Unlike SIMS, where 136 mathematics achievement items were rotated through a class, students in SISS answered all of the 35 items in either the biology, the chemistry, or the physics booklet depending upon the class in which they were enrolled. Attitude items designed to assess affective responses to the subject areas were administered at time of testing. Principals, responding to a school questionnaire, indicated whether the school was semestered or on a full-year timetable.

Achievement levels for students within a school were computed for each item and overall school scores for each biology, chemistry, and physics class were attained by averaging scores across the 35 items. Since not all three class types were tested within all schools, multivariate tests on the achievement measures were inappropriate. One-way analyses of variance were used to compare semestered and non-semestered schools on biology achievement, chemistry achievement, and physics achieve-

ment. Schools on a mixed-system were excluded from the analysis. Differences among students in attitudes for each subject area were assessed using a multivariate analysis of variance (between semestered and non-semestered schools) comparing responses, averaged within schools, for six items:

The marks (grades) I get in science are usually better, average or worse than other subjects;

I like science more, about the same, or less than other subjects;

Biology (Chemistry, Physics) is an enjoyable school subject;

Biology (Chemistry, Physics) taught at school is interesting;

Biology (Chemistry, Physics) is difficult;

Biology (Chemistry, Physics) is relevant to everyday life.

These last four items had five response options ranging from strongly agree to strongly disagree.

RESULTS

Results are presented separately for biology, chemistry, and physics and are based upon responses of 1,297 biology, 1,277 chemistry, and 1,210 physics students. The number of classes (one class maximum for each subject area was tested within a school) is reported in the following sections.

Biology

Forty-three schools contributing biology achievement data were non-semestered while 19 were semestered. The average percentage of students answering the items correctly in the non-semestered schools ($N = 43$, $M = 47.9$, $SD = 6.3$) tended to be higher [$F(1,60) = 3.14$, $p < .09$] than for semestered schools ($N = 19$, $M = 44.8$, $SD = 6.9$). The multivariate test for the attitude items was not significant [$F(6,55) = < 1$]. The univariate tests (with $df = 1,60$) suggested differences ($p < .07$) in favour of the semestered schools for two items: "Biology is an enjoyable school subject" and "The biology taught at school is interesting."

Chemistry

The achievement level in the non-semestered schools ($N = 45$, $M = 41.2$, $SD = 6.9$) tended to be higher [$F(1,64) = 2.81$, $p < .10$] than in semestered schools ($N = 21$, $M = 38.0$, $SD = 8.2$). The multivariate test for the

attitude items suggested differences [$F(6,59) = 1.87, p < .10$]. The univariate tests ($df = 1,64$) indicated differences ($p < .05$) in favour of the semestered schools for the same two item variants as for biology: "Chemistry is an enjoyable school subject" and "The chemistry taught at school is interesting."

Physics

The average percentage of students answering the physics items correctly in the non-semestered schools ($N = 41, M = 40.2, SD = 6.4$) did not differ [$F(1,57) = < 1$] from the semestered schools ($N = 18, M = 39.8, SD = 4.5$) nor was the multivariate test for attitudes significant [$F(6,52) = 1.08, p < .40$]. The univariate tests ($df = 1,57$), however, indicated differences ($p < .05$) in favour of the semestered schools for two items: "The physics taught at school is interesting" and "Physics is relevant to everyday life." For the item "The physics taught at school is interesting," students in semestered schools indicated more favourable responses ($p < .10$) as well.

DISCUSSION

Consistent with the findings reported from SIMS in Ontario (Raphael, Wahlstrom, & McLean, 1986), achievement differences in biology and chemistry tended to favour students enrolled in non-semestered classes. In contrast, however, the attitude findings from SISS indicated that students enrolled in semestered courses projected more favourable attitudes towards science. Perhaps the view that the greater intensive study of a discipline seen in semestered schools promotes better attitudes has validity in the science areas, especially where teaching includes extensive laboratory sessions.

In any event, the results of this and our earlier study appear, at least in Ontario, to be an historical footnote as the last two years has seen a rapid shift away from the year-long timetable. Reports from the field suggest that as many as 90% (in contrast to the 35% at time of SIMS and SISS data collection) of secondary schools in Ontario have now adopted the semester system. Our results draw further attention to educators of possible problems associated with the semestered system.

NOTES

- ¹ The study upon which this paper is based is funded by a grant from the Social Sciences and Humanities Research Council of Canada. The first stage of the study is reported in *Science Education in Canada: Policies, Practices and Perceptions*, Vol. 1 (Connolly, Crocker, & Kass, 1985). The second stage will be reported in Volume 2 to be published in 1986.

- ² The SIMS data were collected during the 1981-82 school year while SISS data was gathered during May/June 1984.

REFERENCES

- Connolly, F. M., Crocker, R. K., & Kass, H. (1985). *Science Education in Canada: Policies, Practices and Perceptions* (Vol. 1). Toronto, OISE Press.
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