Debunking the Semestering Myth

Dennis Raphael
M. W. Wahlstrom
L. D. McLean
the ontario institute for studies in education[1]

Advantages claimed for semester organization of secondary schools were examined using data from a probability sample of 250 mathematics classrooms in 80 Ontario schools. Achievement and attitude data were collected from 5280 students in the course of the Second International Mathematics Study, and it was determined that 94 of the classes were taught in half the school year, i.e., by semesters. Teachers in semester schools were likely to report use of a greater variety of instructional materials. Suggestions reported in the literature of better student attitudes and achievement were not supported, and performance of Grade 12 and 13 students in semestered classes was significantly lower than those in year-long classes. Teachers in semester schools reported comparable coverage of mathematics content, but fewer hours of instruction in their courses. Number of years of teaching experience was not correlated with student achievement in semester schools, but a positive correlation was observed in year-long classes. Lower achievement in semester mathematics classes was observed with no advantage in student attitudes.

On a examiné les avantages que le système trimestriel devrait apporter aux écoles secondaires à l'aide de données ramassées dans un échantillonage de probabilité effectué dans 250 classes de mathématiques dans 80 écoles de l'Ontario. On a ramassé des données sur les résultats et les attitudes de 5280 étudiants au cours de la deuxième étude internationale sur les mathématiques et on a trouvé que l'on enseignait 94 classes durant la moité de l'année scolaire, c'est à dire au cours d'un trimestre. Le enseignants des écoles utilisant le système trimestriel ont indiqué qu'ils se servaient alors d'une plus grande variété de matériel didactique. On n'a pas réussi à prouver la validité de la suggestion qui voudrait que ce système encourage, chez les étudiants, une meilleur attitude envers les études et de meilleurs résultats; la performance des étudiants de 12ème et de 13ème années dans les cours trimestriels était beaucoup moins bonne que celle des étudiants qui suivent des cours pendant l'année entière. Le nombre d'années d'expérience des professeurs n'était pas relié aux résultats obtenus dans les cours trimestriels mais dans le cas des cours annuels, on a remarqué une corrélation positive. On a remarqué des résultats moindres dans les cours trimestriels de maths et aucun avantage au point de vue des attitudes envers les cours.

About one-third of Ontario's 597 secondary schools were operating on the semester system during the school year 1981-82[2] compared with only 24 schools ten years earlier (Ross, 1977). Classes in semester schools meet for half a year, usually for 60-80 minutes per day, in contrast with the traditional system of 40-45 minutes each day over the school year. In order to meet the Ministry of Education requirement for a credit, 110 hours of instruction are required for each mathematics course.

According to its supporters, the semester school offers both administrative and educational advantages over the traditional system. Administrative benefits are said to include greater flexibility in course offerings and selection as well as the possibility of student acceleration through the secondary level program (King, Warren, Moore, Bryans, & Pirie, 1977). The longer period of teacher-student contact is believed to favour the introduction of more varied teaching approaches and techniques, better interpersonal relationships among students, improved motivation and study habits, and higher student achievement (Ross, 1977). On the other hand, it was predicted that teacher and student absence might have a detrimental effect in semester classes because of the longer (and hence fewer) periods (Ross, 1977).

Early small-scale studies (summarized by King et al., 1977) revealed that teachers and students expressed significant satisfaction with semestering.[3] However, these studies suffered from various shortcomings including lack of comparison with year-long classes, failure to take into account student and teacher factors that could influence findings, and the use of weak measures of both attitudes and achievement. Student achievement was usually measured by grades assigned by teachers, and attitudes were tabulated according to responses to attitude items.

Better designed studies appeared in the late 1970s, but these too failed to obtain samples which would allow the results to be generalized and lacked valid and sensitive measures of student attitude and achievement. The designs did not include adequate controls for effects of variables such as teacher experience and student socioeconomic status. Student and teacher questionnaire responses on the semester system were tabulated for eight schools, to show satisfaction with the semester organization, with no comparison groups (King et al., 1977). A greater variety of instructional approaches and more sense of involvement in class decision making by students in semester classes were found by comparing 10 semester schools (7 full-credit and 3 half-credit semester) with 11 control schools (Ross, 1977), but the inappropriate use of the student rather than the class as the unit of analysis may have influenced and biased the results. Another study (Brophy, 1978) found a greater variety of teaching approaches in semestered schools, comparing two schools organized on a full-year system with four semestered schools. Teacher and student responses to questionnaire items were tabulated for semester and year-long classes.

Given the slender evidence for the benefits of a semester organization, it is surprising that researchers (Davis, Ross, Ducharme, & French, 1977) have explicitly recommended that schools organize this way. Mathematics teachers in particular expressed concerns about organizing their courses by semesters (King et al., 1977). Of teachers in semestered advanced level

Grade 11, 12, and 13 courses, 20% felt they could not adequately cover the course content, and an additional 43% had reservations. Thirty-one per cent felt students were forced to cover material too quickly, and an additional 32% agreed that this problem occurred "to some extent." Half felt the difficulty was caused by long breaks between the periods when a subject was studied (because of "chunking" into semesters). A more recent review of research (Sprumont, 1979) cited evidence that semester classes in Ontario frequently fell short of the 110 hours of instruction required for each course credit, suggesting that teachers in semester courses were concerned about lower student retention and inadequate topic coverage.

THE SECOND INTERNATIONAL MATHEMATICS STUDY (SIMS)

The present study was able to avoid many of the design flaws that weakened previous research on the effects of semester organization. The carefully designed and executed sample was representative of classes in Ontario, and the proportion of semester classes is just as would be expected. It was not possible to sample from semester and full-year classes, however, so the possibility of a sampling bias in favour of any one type of organization cannot be eliminated. There were systematic differences between those schools and classes opting for semesters and those which did not, and an attempt has been made to allow statistically for these differences wherever possible.

The measuring instruments prepared for the Second International Mathematics Study and used in Ontario were carefully field tested, revised, and refined, and the relevance of the achievement items to the Ontario curriculum was established. The attitude scales were highly reliable. A high rate of return was achieved for the teacher forms which reported allocation of teaching time, uses of various instructional methods and materials, and many other aspects of their teaching. Details of the complex study have been published elsewhere (McLean, Raphael, & Wahlstrom, 1983, in press; Raphael, Wahlstrom, & McLean, 1983a, 1983b, 1984). Except for the analyses involving Grade 13 mathematics specialists (where the school was the unit of analysis), the class was used as the unit of analysis.

In this paper, data from semester and year-long courses are compared in terms of (a) teachers' instructional practices and beliefs, (b) topic coverage, and (c) student attitudes and achievement. As noted above, the advocates of semester classes predict that teachers will be more likely to use a variety of teaching methods and materials and that students will have better attitudes toward mathematics and also higher achievement.

DESIGN AND METHODOLOGY OF THE STUDY

The design and methodology are fully described in McLean, Raphael, and Wahlstrom (in press).

Sample

The SIMS population was defined as those students enrolled in the normally accepted terminal year of secondary school who were studying mathematics as a substantial part (approximately five hours a week or more) of their academic program. In Ontario the students most comparable to those in other parts of the world were those enrolled in two or more Grade 13 mathematics courses.[4] Data were also collected from Grade 12 classes for local use and to allow comparison with students in other jurisdictions (especially British Columbia and the U.S.) where Grade 12 is the normal terminal year. Only British Columbia and Ontario were involved in the study for Canada. All Ontario schools containing Grade 13 classes were assigned to one of 17 strata by (a) size of community, (b) school type (private, French, public), (c) ratio of number of Grade 12 to Grade 13 students (a socioeconomic index), and (d) geographical region of the province. No information was available on semester organization, so it could not be made part of the sampling design. Five schools were selected at random from each of the 17 strata. A list of all mathematics classes was obtained, and then the OISE team selected four classes from each school — one Grade 12 and one each of Relations and Functions, Calculus, and Algebra. Random selection was made whenever more than one class of a type was available in the school. The five French-language schools were not included in the present analysis since none was on a semester plan. Some schools did not have four classes, and some schools dropped out at a time when no replacement was possible. The achieved sample contained 250 classes, of which 94 were on a semester plan. Relatively complete data were obtained from all 250 teachers.

Teacher Questionnaires

Data were collected by means of elaborate questionnaires on school organization, personal background, attitudes, classroom practices, time allotted to topics, and achievement item coverage. More details will be given as the instruments come up for discussion.

Student Instruments

Achievement instruments

One hundred and thirty-six mathematics items were chosen by an international committee to cover the mathematics curriculum in participating countries. These were classified into one or more of 27 subsets by topic, only 11 of which are used in this report. The items were examined by an Ontario Steering Committee, consisting of mathematics educators at all levels, to determine (a) their appropriateness to the Ontario curriculum, (b) whether each item was likely to be covered in a Grade 11, Grade 12, or Grade 13 class, and (c) whether the content needed to answer the item was found in a widely used Grade 12 or 13 textbook.

The percentages of items rated as appropriate are presented in Table 1. Most items were included in the Grade 12 Foundations course, and virtually all the Differentiation and Integration items were covered in the Calculus course. The Relations and Functions and Algebra courses, although including some of the items, did not map well on the international subsets. Overall, however, all but 16 (12 %) of the 136 items were judged to require mathematics knowledge taught in one of the four courses. Ninety-four per cent of the items were said to require mathematics covered in at least one of the textbooks commonly used in Grade 12 or 13.

All 136 items were allocated by stratified random sampling to one of eight forms so that each form contained 17 items. Each student completed only two of the eight forms in successive class periods toward the end of the course. Some semester classes completed the forms in December, but most (including approximately four-fifths of semester classes) completed them in May.

Attitude instruments

Four scales were constructed: *Mathematics in School*, ratings of the importance of, facility in, and appreciation of 15 activities; *Mathematics and Myself*, whether the student had a positive or negative view of the subject; *Mathematics in Society*, whether the student perceived mathematics as useful in work and daily life; and *Mathematics as a Process*, the degree to which mathematics was seen as a living discipline requiring creativity and openness. The 95 items in the four scales were presented in a questionnaire that all students completed before answering the achievement items. Items from the several scales were mixed in random order.

TABLE 1

Percentage of Items in SIMS Subsets Covered in Ontario Grade 11, 12, or 13 Courses in the Opinion of the Ontario Steering Committee

Content (Subset)	*No. of Items*	*Percentage of Items in Each Course*			
		Grade 11, 12	*Relations*	*Calculus*	*Algebra*
Number Systems	11	72	18	9	18
Complex Numbers	6	0	50	100	50
Analytic Geometry	6	83	17	0	33
Algebra (Computation)	10	80	0	0	30
Algebra (Other)	16	88	25	0	25
Equations and Inequalities	13	100	8	8	23
Functions	17	76	35	12	6
Trigonometry	8	88	38	0	0
Differentiation	14	7	0	78	0
Integration	12	0	0	92	0
Probability and Statistics	6	67	33	17	33

Procedure for Involving Schools in the Study

Schools were encouraged by the Ministry of Education to participate, and most cooperated quite willingly. Materials were dispatched by courier and addressed to the teachers by name. Completed instruments were returned by the same courier, except for the teacher questionnaires which were returned by mail. Many of the latter were designed to be completed just after teaching a topic. Some replacement schools had to be drawn (from appropriate strata) when special circumstances prevented a school in the first round sample from participating.

Socioeconomic Status

Students were asked to name and describe both their mother's and their father's occupations. The OISE team then assigned a number from 0 to 9 based on a combination of some of the categories of the 16-point Pineo-Porter scale of occupational prestige (Pineo, Porter, & Roberts, 1977). If both parents were assigned an occupation, the higher status one was used.

RESULTS

Except for the analyses of attitudes and achievement among Grade 13 mathematics specialists (where the school was used as the level of analysis), the classroom was used as the unit of analysis in all the results that follow. Multilevel, or hierarchical, models would be appropriate for exploring many hypotheses that arise from the study, but this investigation into the possible effects of semester organization is based upon class- and school-level models. Error variances reflect the sampling as well as variation among classes and schools.

Background Variables

Students' average socioeconomic status did not differ significantly between semester and full-year classes [$F(1,232) < 1$] or among the various mathematics courses [$F(3,232) < 1$], nor was the semester by course type interaction significant [$F(3,232) < 1$].[5] Teachers in semester classes had significantly fewer years of teaching experience than those in full-year classes [14.4 vs. 16.5, $p < .05$]. Correlations among the measures were comparable in semester and full-year classes, with the exception of *years of experience* and *achievement* which were not correlated in semester classes but positively correlated in Grade 13 Calculus and in Grade 12 year-long classes.

Variations in Teacher Instructional Behaviour

Teachers' reports of use of materials and individualization of instruction in the two groups were compared because of the predictions in the literature that a greater variety of materials would be used in semester classes and the possibility that such variety might lead to greater individualization.

Use of materials

Teachers reported on a three-point scale (*rarely*, *sometimes*, or *often*) the extent to which each of seven materials were used: published textbooks, published workbooks, individualized materials, commercially produced visual materials, commercially published tests, self-prepared teaching materials, and teacher-made tests. These reports were entered as seven dependent variables in a two-factor (*semester* by *course type*) multivariate analysis of variance with *years of teaching experience* as a covariate. A summary of the analysis is presented in Table 2. Subsequent analyses of the same form will be summarized in the text rather than in a table.

The multivariate regression (on the covariate) suggested some effects ($p < .11$), and significant univariate tests were observed for visual materials. More experienced teachers were more likely to use visual materials. No significant differences appeared among the factors nor in their interaction when the multivariate tests were consulted. Some significant univariate results appeared that were consistent with predictions (teachers in semester classes were more likely to use workbooks, individualized materials, and visual materials), but the differences, if real, are probably not very large.

Individualization of instruction

Teachers indicated (by a percentage) how they divided class time into whole-class activities, small-group instruction, or individualized work, and (on a three-point scale) the extent to which they varied the presentation of content and assignments. One variable, *years of teaching experience*, was related to the dependent variables [multivariate $F(5,234) = 2.30$, $p < .05$], but not to any one in particular. The multivariate covariance analysis yielded only one main effect, for semesters [$F(5,234) = 2.10$, $p < .07$], due principally to differences in the percentage of time devoted to whole-class instruction. Teachers in semester classes reported spending less time in whole-class instruction than teachers in year-long classes.

TABLE 2

Summary of Multivariate Analyses of Teacher Responses on Use of Various Materials in Their Teaching. Two-factor Design (Semester by Type of Course) with One Covariate (Teaching Experience)

Regression on Teaching Experience	
Multivariate $F(7{,}224) = 1.71$, $p = .11$	
Univariate Tests	
Visual materials	$t = 2.59$, $p = .01$
Individual materials	$t = 1.35$, $p = .18$
Published tests	$t = 1.37$, $p = .17$
Own tests	$t = 1.57$, $p = .12$
Remaining variables	$t < 1$
Analysis of Uses of Materials, Adjusted for Teaching Experience	
Semester by Type of Course	
Multivariate $F(21{,}644) = 1.01$, $p = .44$	
Univariate Tests	All F values less than 1
Type of Course	
Multivariate $F(21{,}644 = 1.11$, $p = .32$	
Univariate Tests	
Use published tests	$F(3{,}230) = 3.46$, $p = .02$
Individualized materials	$F(3{,}230) = 1.98$, $p = .12$
Remaining variables	$F(3{,}230) < 1$
Semester	
Multivariate $F(7{,}224) = 1.27$, $p = .22$	
Univariate Tests	
Workbooks	$F(1{,}230) = 2.86$, $p = .09$
Individualized materials	$F(1{,}230) = 2.99$, $p = .08$
Visual materials	$F(1{,}230) = 3.30$, $p = .07$
Use published tests	$F(1{,}230) = 1.69$, $p = .20$
Remaining variables	$F(1{,}230) < 1$

Causes of unsatisfactory student progress

Teachers rated nine possible reasons why students might not make satisfactory progress in their classes: lack of student ability, misbehaviour, indifference or lack of motivation, fear of math, absenteeism, insufficient school time, insufficient personal proficiency, limited resources and materials, and too many students. In the reasons offered for lack of satisfactory progress, there were no significant differences between semester and year-long classes or among the courses. Less experienced teachers were more likely to report lack of student ability and teacher self-proficiency as important causes for poor student progress ($p < .05$).

Number of Hours of Mathematics Instruction

The data mildly supported the assertion (Sprumont, 1979) that time allocation in semester classes frequently fell short of the required 110 hours. A *semester* by *type of course* analysis of variance yielded a suggestion of a semester effect [$F(1,242) = 3.07$, $p < .09$] due to a lower average number of hours reported by teachers in semester classes (106.8 vs. 116.0). Of the 94 teachers in semester classes, 39 (41%) reported fewer than 110 hours of instruction, whereas 40 (26%) reports from year-long classes were less than 110. There were no significant differences among types of course nor was the interaction significant.

Topic Coverage

An important issue is the extent to which teachers in semester classes have the opportunity to cover the course content. As noted above, the only courses that matched the achievement subsets closely enough to permit a topic-by-topic analysis were the Grade 12 and the Calculus courses. Teacher reports of coverage of items in the subsets were aggregated to the topic level within each class to make the comparisons.

Grade 12

Eight topic subsets were appropriate: Number Systems, Algebra (computation), Algebra (other than computation), Equations and Inequalities, Trigonometry, Analytic Geometry, Functions, and Probability and Statistics. The number of items per subset varied from 6 (Analytic Geometry, and Probability and Statistics) to 17 (Functions).

The variable of *years of experience* was not related to subset item coverage, so semester and full-year classes were compared by a one-way multivariate test (Hotelling T^2). There were no significant differences.

The same analysis was applied to the coverage reports for *calculus topics* on items in the Differentiation and Integration subsets, with the same results – no significant differences.

Student Attitudes towards Mathematics

The attitude scales yielded the following reliability indices (Cronbach *alpha*): *Mathematics and Myself*, 0.9; *Mathematics as a Process* and *Mathematics in Society*, 0.6, and *Mathematics in School*, 0.8.

Multivariate regression analysis of *attitudes* on *teaching experience* was not significant. A multivariate analysis of variance (*semester* by *type of course*) yielded a semester effect [$F(6,231) = 5.09$, $p < .01$]. Contrary to predictions, students in semester classes gave responses that reflected less positive attitudes than their peers in year-long classes. The effect was strongest on the Mathematics as a Process scale (" ... useful in solving everyday problems, involves mostly memorizing, problems always have only one right answer, good field for creative people ...").

There were strong differences among the types of classes [$F(18,654) = 8.60$, $p < .01$] on all the scales. Students in Grade 13 Algebra classes projected the most positive attitudes, and students in Grade 12 the least. Grade 13 Algebra is the most abstract of the mathematics coures, attracting the keenest and most able students, whereas the Grade 12 course includes virtually all students who are headed for post-secondary education and some who are not.

STUDENT ACHIEVEMENT IN MATHEMATICS

The 136 multiple-choice achievement items were administered in books of 17 items, randomly assigned to students in a class. The design called for each student to complete two books, and over 5000 students did. The items were administered by item-sampling, and no student wrote all the items in any subset; results are summarized by *class means* of number correct on subsets of items (grouped by topics) for the Grade 12 classes and *school means* for the Grade 13 results. These means are the average number correct among all responses to those items in the class or school. Complex minimum response criteria were applied to ensure stable estimates of average achievement (McLean et al., in press). Because their content is widely taught, eight subsets were judged to be appropriate for comparing Grade 12 classes and 11 subsets were appropriate for students taking two or more Grade 13 mathematics courses.

Grade 12 Foundations of Mathematics

Previous analyses have used the teacher's experience as a covariate since semester classes differed systematically from year-long classes on this variable, and regressions were homogeneous. Correlations presented in

TABLE 3
Correlation of Years of Teachers' Experience with Ontario Grade 12 Students' Achievement in Semester and Year-Long Classes

Achievement Subset	*Semester (n = 21)* Pearson *r*	*P*	*Year-Long (n = 37)* Pearson *r*	*P*
Number Systems	-.06	ns	.30	.04
Algebra (Computation)	-.30	.10	.46	.00
Algebra (Other)	.08	ns	.27	.05
Equations and Inequalities	.03	ns	.39	.01
Analytical Geometry	-.13	ns	.33	.02
Trigonometry	-.08	ns	.02	ns
Functions	-.10	ns	.25	.06
Probability and Statistics	.01	ns	.07	ns

Table 3 illustrate that teaching experience would not be an appropriate covariate when testing for differences in achievement between semester and year-long classes. A simple multivariate test was performed (Hotelling T^2) on the mean vectors, with no covariate, leaving the possibility that differences are due in part to differences in teacher experience. The size of the correlations suggests, however, that such an effect would be modest at best.

The multivariate test suggested that achievement differences might be present [$F(8,56) = 1.75$, $p < .11$], and significant univariate differences were found ($p < .05$) on four of the eight subsets (Number Systems, Algebra (Other), Equations and Inequalities, and Analytic Geometry). On two other subsets (Functions, and Probability and Statistics) small differences may well exist ($p < .10$). From the summary presented in Table 4, it may be verified that students in year-long classes achieved higher mean scores on every subset. Only on the algebra questions requiring computation were the two groups almost comparable, the Trigonometry subset being so difficult that students answered near the chance level (20%).

Grade 13 Mathematics Specialists

If there are systematic effects due to the organization of mathematics classes in semesters rather than the full year, then these effects should be especially prominent in students taking two or more mathematics classes

TABLE 4

Percentage of Subset Items Answered Correctly by Ontario Grade 12 Students Enrolled in Semester and Year-Long Classes

Achievement Subset	*Semester (n = 23)*		*Year-Long (n = 39)*		*Univariate F-Ratio (1,60)*	*P*
	Mean	*SD*	*Mean*	*SD*		
Number Systems	31.6	11.47	38.5	12.10	5.05	.03
Algebra (Computation)	38.3	13.70	41.3	11.10	.90	ns
Algebra (Other)	27.6	9.52	34.5	10.50	6.96	.01
Equations and Inequalities	31.8	11.62	40.2	11.89	7.36	.01
Analytical Geometry	22.3	9.44	28.5	10.82	5.23	.03
Trigonometry	23.6	9.88	25.6	12.56	.46	ns
Functions	32.8	11.97	37.7	10.65	2.94	.09
Probability and Statistics	28.8	9.97	33.6	9.29	3.80	.06

in Grade 13. For this analysis, only the mathematics specialists in classes were used to calculate school means. The analysis is possible because most students who take mathematics in Grade 13 are specialists by this definition.

Socioeconomic level

Groups were tested again for differences on this variable because it usually is correlated with plans to attend university. There was no significant difference between semester and year-long classes [$F(1,69) < 1$].

Student attitudes

Mathematics specialists in year-long classes presented marginally higher scores on the Mathematics as a Process scale [$F(1,69) = 2.83, p < .10$], but the multivariate test was not significant, and it would appear that students in the two types of classes have similar attitudes to mathematics.

Student achievement

Mathematics specialists in year-long classes achieved higher scores on every subset appropriate for comparisons (see Table 5). There was no significant difference on Trigonometry (where the scores came well above the chance level) or Complex Numbers (where they did not). The difference between the groups was larger than in Grade 12 for the algebra items not involving computation, that is, on the more abstract content. There was also a large difference on the Differentiation subset, not a particularly abstract topic but one basic to the calculus.

It was mentioned earlier that some semester classes participated in the study in December, which would have meant they answered the achievement items earlier in their course than those who participated in May (the first semester in Ontario ends near the end of January, the second in June). Results from these classes were analyzed separately in case they were pulling down the average of the semester classes. The classes participating in December had *higher* averages than those participating in May (although still lower than the year-long classes).

CONCLUSIONS

There may be many reasons for choosing a semester organization for a school, but educational advantage in terms of student attitudes and achievement does not appear to be one of them – at least not in mathematics classes. Instead of the more positive attitudes predicted, students in semester classes had either less positive or similar attitudes. Mathematics achievement was, however, clearly greater in year-long classes. None

TABLE 5

Percentage of Subset Items Answered Correctly by Ontario Grade 13 Mathematics Specialists Enrolled in Semester and Year-Long Classes

Achievement Subset	*Semester (n = 27)*		*Year-Long (n = 44)*		*Univariate F-Ratio (1,69)*	*P*
	Mean	*SD*	*Mean*	*SD*		
Number Systems	52.1	5.99	57.4	6.28	12.45	.00
Complex Numbers	28.6	12.08	34.8	17.25	2.69	.10
Algebra (Computation)	63.4	7.33	69.5	7.44	11.33	.00
Algebra (Other)	47.7	6.91	54.0	5.92	16.88	.00
Equations and Inequalities	53.7	7.35	59.4	5.71	13.36	.00
Analytical Geometry	42.4	7.84	48.3	6.74	11.42	.00
Trigonometry	47.4	9.22	49.6	9.68	.90	ns
Functions	55.3	5.65	61.3	6.76	15.06	.00
Differentiation	39.3	7.43	50.3	7.73	34.90	.00
Integration	38.1	10.76	46.9	8.23	15.17	.00
Probability and Statistics	43.7	6.99	47.9	9.18	4.28	.04

of the background measures available showed any difference in student, teacher, or school characteristics that could provide an alternate explanation for the achievement and attitude differences.

The one possible exception was the amount of teaching experience, since teachers in year-long classes had on average just over two more years experience than their colleagues in semester classes. Where appropriate, allowance was made for this possible difference by statistical means. Reviews of the literature suggest in any event that teacher effects, for which *years of experience* is at best a weak surrogate, "are likely to be small when compared with the totality of the effects of the other variables affecting student achievement" (Centra & Potter, 1980, p. 287). The most parsimonious explanation is that students learned more mathematics in the full-year classes and developed at least as good an attitude toward the subject.

NOTES

[1] The project from which these data were obtained was funded under contract by the Ministry of Education, Ontario. The views expressed in this paper are those of the authors and not necessarily those of the Ministry.

[2] Based on estimates provided by members of the Ontario Association of Mathematics Coordinators.

[3] A search of educational and psychological sources produced only a handful of references, all of the empirical studies having been done in Canada.

[4] When the study was done, students in Ontario were required to complete six "honours" courses after Grade 12 with at least a 60% average to qualify for university admission. A new system of "academic credits" is currently being phased in. There were three university-oriented mathematics courses available, and many students took all three.

[5] Analysis of variance tables will be omitted wherever possible in the interests of brevity, as the number of variables was rather large.

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Vorteile, die für die Semesterorganisierung der höheren Schulen in Anspruch genommen wurden, wurden unter Anwendung von Daten einer Wahrscheinlichkeitsprobe von 250 Mathematikklassen in 80 Ontario Schulen untersucht. Leistungs- und Verhaltensdaten wurden von 5280 Schülern während der "Second International Mathematics Study" [zweiten internationalen Mathematikuntersuchung] gesammelt, wobei festgestellt wurde, daß 94 der Klassen in der Hälfte des Schuljahres unterrichtet wurden, d.h., in Semestern. Lehrer in Semesterschulen haben eher Gebrauch von einer größeren Auswahl an Lehrmitteln berichtet. Behauptungen vom besseren Schülerverhalten und von besseren Leistungen, was in der Literatur angegeben wurde, wurden nicht bestätigt. Die Leistungen der Schüler des 12. und 13. Schuljahres in Semesterklassen waren bedeutend niedriger als die der Schüler in einjährigen Klassen. Lehrer in Semesterschulen berichteten ähnliche Umfassung von Mathematikinhalt, jedoch weniger Lehrstunden in ihren Kursen. Die Anzahl der Jahre von Lehrerfahrung wurde nicht in Wechselbeziehung mit Schülerleistung in Semesterschulen gezogen, es wurde jedoch eine positive Wechselbeziehung in einjährigen Klassen wahrgenommen. Niedrigere Leistungen in Semester-Mathematikklassen wurden bemerkt, jedoch kein Vorteil im Schülerverhalten.

Se examinaron las ventajas de la organización por semestres en escuelas secundarias, usando datos de una muestra de probabilidad de 250 clases de matemáticas en 80 escuelas de Ontario. Se recolectaron datos de logro y actitud de 5280 estudiantes en el marco del Segundo estudio internacional de matemáticas, y se determinó que 94 de las clases se enseñaban en medio año escolar, es decir por semestres. Los maestros en las escuelas enseñando por semestres tenian mayor tendencia a informar que usaban una mayor variedad de materiales de enseñanza. Las implicaciones en la literatura de actitudes y logros mejores por parte de los estudiantes no fueron respaldados, y el rendimiento de estudiantes de Grado 12 y 13 en clases por semestres fué sensiblemente peor que los de los estudiantes en clases de año entero. Los maestros en escuelas por semestre informaron enseñar el mismo contenido de matemáticas pero tenian menos horas de enseñanza en sus cursos. Los años de experiencia magisterial no estaban relacionados con el rendimiento estudiantil en las escuelas por semestre, pero se observó una relación positiva en las clases de año entero. Se observó menor rendimiento en las clases de matemáticas por semestre sin ventajas de actitud por parte de los estudiantes.

Dennis Raphael is a research associate and instructor in the Educational Evaluation Centre and the Department of Applied Psychology, and M. W. Wahlstrom is an associate professor and L. D. McLean a professor in the Department of Measurement, Evaluation and Computer Applications, The Ontario Institute for Studies in Education, 252 Bloor Street West, Toronto, Ontario M5S 1V6.