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AUTHOR Grapko, Michael F.; Snider, M. J.
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ABSTRACT

This study explores the effects of physical differences in the architectural design of schools by comparing behavioral and performance variables for two groups of pupils: (1) those who had previously attended an open space school, and (2) those who had always attended classes in a traditionally built school. Three major variables are examined: academic performance, motivation for school, and security development. Differences in school marks, teacher assessment, I.Q. scores, sex and grade level are also explored. Four classes of grade 7 pupils and three classes of grade 8 pupils (a total of 210 subjects) are included in the study. The tests employed were the Institute of Child Study Security Test-Elementary Form, the Canadian Tests of Basic Skills, the Frymier Junior Index of Motivation, the Dominion Group Test of Learning Capacity-Intermediate Form, and a pupil rating scale. Results from these tests are discussed in detail. (ED)

FINAL REPORT

THE EFFECT OF THE OPEN SPACE SCHOOL ON CHILDREN'S SECURITY AND INDEPENDENCE DEVELOPMENT, ACADEMIC PERFORMANCE, TEACHER ASSESSMENTS AND SCHOOL MOTIVATION

- *Michael F. Grapko, Principal Investigator*
- *M. J. Snider, Research Associate.*

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THE EFFECT OF THE OPEN SPACE SCHOOL ON CHILDREN'S SECURITY AND INDEPENDENCE DEVELOPMENT, ACADEMIC PERFORMANCE, TEACHER ASSESSMENTS AND SCHOOL MOTIVATION.[1]

A. Purpose and Background

Several studies have been reported recently dealing with a variety of characteristics and variables related to open education (Cockburn, 1974; Bart and Rathbone, 1971). The meaning of open education, open space instruction, open plan, open classroom, open school and open concept is not always clear and some investigators are inclined to use the terms interchangeably. Tatis (1972) has prepared a guide to new vocabulary dealing with open space, attempting to provide greater specificity to such terms as open education, open classroom and so on. Barth (1970, 1972), Marshall (1972) and Rathbone (1972) refer to open classroom in accordance with specific criteria. Barth proposes that open classrooms imply for children a choice of activity, ability to pose new problems, freedom to collaborate with peers, situations of trust and order without authoritarianism, and minimal performance comparison.

Marshall proposes a long list of criteria according to three broad categories. The first category deals with criteria which reflect the growth of each individual child toward achieving his potential. The second category particularly distinguishes open from traditional classrooms and includes four criteria, namely: (1) the atmosphere is permeated with an openness, an awareness, and a respect toward others; (2) the teacher is a facilitator of learning, a catalyst who is a resource person; (3) opportunities are provided for children to assume responsibility and draw on their own resources for initiating, choosing, directing, and evaluating their own learning; and (4) learning occurs because it is personally meaningful to the child. The third category deals with four characteristics: (1) learning topics are interdisciplinary and integrated; (2) the learning environment is rich and varied; (3) there is a

1. This study was supported by a Grant-in-Aid for Educational Research from the Ministry of Education, Ontario.

minimal amount of scheduling and a flexibility in the day; and (4) there is an openness in the spatial arrangement of the learning environment.

Rathbone points to organizational features of the open education classroom which deals with the organization of space, time, instruction, and the grouping of children. He stresses, however, the need for critical analysis of open education to establish clearer goals and better means of evaluation and for research to determine its appropriateness in terms of types of children and kinds of learning.

Traub, et al (1972) have designed a questionnaire for teachers which obtains information on aspects of school life important in open education. The responses can be used to measure the degree of openness of a program. Burnham (1970) describes what it is like to be a pupil in an open plan school. He stresses the importance of pupil initiative, responsibility, cooperation, inquiry, security, and acceptability of the open plan arrangement. MacDonald (1969) emphasizes among other things the importance of independent study and individualized instruction.

It would seem therefore that open space education has a primary focus on attitudes, curriculum selection, the role of the teacher and methodological issues, and only incidentally on the architectural features of open space construction. It is implied that new approaches in open space construction are more compatible with the educational objectives of open space education but perhaps not exclusively. On the other hand, the reference to traditional classrooms as opposed to open space classrooms tends to imply more traditional attitudes and practices in education, methods which are teacher-based rather than child-centred, and time tables which are designed for the convenience of the school rather than the interests of the child.

To suggest that all schools with open space construction comply with the objectives of open education is perhaps as inappropriate as to imply that all traditional classrooms bounded by four walls strictly adhere to what may be termed the traditional approach in education. Kyzar (1971) selected three open space elementary schools which were matched with conventional schools and found no conclusive differentiation in the instructional programs between the two school structures. Jaworowicz (1972) examined the effects of the open space school on the patterns of interaction between the principal and teachers and reports that the design itself does not produce any alterations. He also states that principals moving to open space schools were similar in philosophical

orientation toward openness to those staying in traditional schools.

While research on open space which deals primarily with open and traditional education is important and necessary, the present study is confined to examine the impact that may derive from the architectural differences between open space and traditional type classrooms. Spigel (1974) in a study dealing with evaluation of open area schools distinguishes between open education and open space, commenting that "in the proposed study of open area schools, we are attempting to evaluate the effect of a type of construction upon what happens to pupils and not the effect of a so-called open approach to children or curriculum which may be present in any type of construction."

Warner (1970) conducted his study in an elementary school of traditional design with an open area addition. Since the instructional program was the same in both facilities, the only variable was the design of space. Warner found no differences in the interaction between teachers and pupils, however, it was observed that in the open area, space was used more flexibly, more supplementary materials were available, and there was greater variability in grouping of pupils.

While the physical differences in the architecture of traditional and open space schools would tend to encourage or contribute to certain organizational changes, these changes have by no means been widespread throughout all open space schools. In some cases, where teachers have been uncomfortable in open space areas, they have created their own walls by positioning blackboards, bookcases and other furniture to re-establish a sense of privacy or boundary; and have arranged tables and desks so that children are required to face away from the open areas. In other cases, teachers have been challenged by the open concept and have maximized the opportunities of open space areas to achieve the objectives cited by Marshall (1972).

While the present study examines the effect of physical differences in architectural design of schools, the specific purpose of the research is to evaluate behavioural and performance variables for two groups of pupils, where one group had previously attended an open space school[2], and the other group of pupils had always attended classes in a traditionally built school.

The study was conducted in a small town located in the jurisdiction of the Grey County Board of Education. Two elementary schools are located in the

2. The program in the open space school used in this study includes a partial rotary plan, individualized curriculum, variable grouping of pupils, flexible time table, freedom for children to work independently, access to the resources of the school, and encouragement for peer group activities.

town. The open space school (OSS) was built in 1970 and designed as a fully open space school.[3] Prior to 1970, all children in the town attended the traditionally structured school (TSS) which was built about thirty-five years ago. Presently, children from kindergarten to grade 6 attend either the OSS or the TSS depending on geographical boundaries in the town. Almost all children who reside out of town, and are bused to school, attend OSS. All children on reaching grade 7 attend the TSS and continue studies until completing grade 8.

A total of 210 pupils was included in the study, 126 pupils previously attended the open space school (OSS) and were presently attending TSS and 84 pupils were in continuous attendance at TSS. The study was designed to test for statistical differences among several variables between the two groups of pupils.

The purpose of the study was to show effects, if any, that could be attributed to attendance at an open space school. Three major variables were examined, namely academic performance, motivation for school and security development. Three additional variables included in the study dealt with school marks, teacher assessment of pupils and I.Q. scores. Sex and grade level differences were also explored.

In 1971-72, the pupils attending grades 5 and 6 at OSS and TSS were used in a comparative study employing personality variables, academic performance, and teacher assessments. (Grapko, 1973). Some of these data have been used to establish a baseline for repeat measures on the same children included in the present study as well as to derive change measures in security development.

While the research literature dealing with the effect of open space schools on children's performance and behaviour is meagre, the findings are by no means unequivocal. Heimgartner (1972) reports that open space facilities provided some slight gains to children in self-esteem and individuation while La Forge (1972) finds no significant personality effects for children in the open space designed school.

Sackett (1971) using grade 6 children finds that pupils attending the open space school scored significantly below in self-concept to pupils in conventional schools. Wilson, et al (1969) in one of the earlier studies on open space schools report pupils from open space schools to have a more positive attitude toward school, to show no significance in level of curiosity from pupils in traditional schools, and to be somewhat lower in creativity.

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3. This is in contrast to partial open space or a pod designed school, where two, three or four classrooms only may be spatially integrated.

Ramsay and Piper (1974) found that children from an open classroom setting did significantly better on figural creativity than children from a traditional classroom, whereas the reverse was shown for verbal creativity.

Bleier (1972) found that pupils in open space classrooms were less likely to yield to external suggestion in resolving general knowledge problems than pupils from traditional classrooms. Lynch (1972) in a questionnaire study dealing with grade five and six pupils reports that pupils from open space areas had less feeling of anonymity and better perceptions of their teachers' expectations than those in conventional classrooms. Myers (1971) using a checklist found that third grade pupils from open space classrooms appeared to be less dependent on the teacher and placed more emphasis on the fairness of the teacher than pupils from self-contained classrooms. McCallum (1971) found no differences between pupils in open space and traditional schools in respect to the nature, intensity or duration of problems reported by children and by teachers.

Wren (1972) examined differences in affect between pupils attending open space and traditional classrooms. She found pupils in open space classrooms to show no significant difference in anxiety to pupils in traditional classrooms. The St. Avila project (1970) which added an open area to a traditionally designed school found that pupils assigned to the open area were slightly ahead in their personal adjustment to pupils assigned to traditional classrooms in the school. Wain (1972) found high extrovert boys to achieve better in traditional and open space programs; whereas low extrovert boys appeared to achieve best in a mixed program where both traditional and open space programs were available. This difference was not shown for girls.

The effect of open space on children's academic performance is reported by Brunetti (1971), Burham (1971), Grapko (1973), McRae (1970), Townsend (1971), and Warner (1970). The studies report that pupils in open space schools show either no difference in academic performance or perform somewhat lower academically than pupils in traditional schools. Brunetti states that open space architecture without a change in program has no consistently measurable effect on pupil performance. Burham and Warner found no difference in achievement scores in their studies; whereas Grapko, McRae and Townsend report slight advantages in academic performance to pupils in traditional as against open space schools. Grapko found that pupils who were in open space classrooms and were in the bottom half of the I.Q. distribution accounted for the drop in academic performance, and that no difference in academic achievement was noted for pupils in open space or traditional classrooms when only children in the upper half of the I.Q. distribution were compared.

The attitude of teachers toward pupils who attend open space schools receives some attention from Mills (1972), Meyer (1971), Townsend (1971), Matheson (1970), and Grapko (1973). Mills found that teachers in open space schools were more accepting and supportive toward their pupils. Matheson reports that teachers find pupils in open space to be better motivated and disciplined, and Meyer concludes that pupils are less dependent on their teachers. Grapko shows that teachers in open space schools tend to rate pupils more closely to pupils' self reported scores on a personality questionnaire.

B. Method

Subjects

Four classes of grade 7 pupils and three classes of grade 8 pupils were included in the study. There were 210 pupils, 126 had previously attended the open space school and 84 were continuing in the same traditionally structured school. Table 1 shows the percentages between boys and girls for each grade and the percentage of grade 7 and grade 8 pupils in respect to previous school experience. The frequencies are shown at the bottom of each cell.

Table 1

Percentage distributions for pupils in open space and traditional classrooms:

	OPEN			TRADITIONAL			
	Grade			Grade			
	7	8	TOTAL	7	8	TOTAL	
BOYS	59.0% 66.7 36.5 46	47.9% 33.3 18.3 23	54.8% 69	62.5% 59.5 29.8 25	38.6% 40.5 20.2 17	50.0% 42	
GIRLS	41.0% 56.1 25.4 32	52.1% 43.9 19.8 25	45.2% 57	37.5% 35.7 17.9 15	61.4% 64.3 32.1 27	50.0% 42	
PERCENT TOTAL	61.9% 78	38.1% 48	100.0% 126	47.6% 40	52.4% 44	100.0% 84	210

Upper cell entries are percent of column totals
percent of row totals
percent of sub-table total.

Tests Employed

The Institute of Child Study Security Test - Elementary Form, called "The Story of Jimmy", was used to obtain three measures, namely an overall security score, a consistency score, and a score reflecting the pupil's preference for independence behaviour. The test elicits an order of preference for various behavioural responses to each of fifteen situations described in story form and terminating with five choices of action. (Appendix 1). The security score measures the child's confidence in his own ability to accept consequences for his decisions and actions. The consistency score identifies the similarity of response pattern the child selects for the fifteen situations and is found to correlate with organizational ability and good work habits. The independent security score is based on the sum of the rank designations which is given to this response in each of the fifteen situations. Accordingly, the score is the aggregate rank.

The Canadian Tests of Basic Skills provide information on the progress of pupils in a number of academic areas. The main purpose of the tests is to determine how well each pupil has mastered the basic skills. One specific application of the tests as described by the authors is to compare pupils in one class with those in other classes of similar grade level or in other schools. The basic skills used in the present study include vocabulary, reading comprehension, language usage, knowledge and use of reference materials, mathematics concepts and mathematics problem solving.

The Frymier Junior Index of Motivation, called the JIM scale, attempts to measure the pupil's motivation for school. Eighty statements are provided and the pupil is asked to indicate a slight or a strong agreement or disagreement for each item. Reliability coefficients obtained for grade 7 and grade 8 pupils on a test-retest basis on a ten-month interval for 717 cases is .70. Validity studies are reported. Only 50 statements are used in the scoring.

The Pupil Rating Scale consists of six traits, three dealing with performance variables and three describing behavioural variables. Each teacher rates the pupils in the class on a five point scale. The six items in the rating scale were selected from fourteen items used in a previous study (Grapko, 1973).

The Dominion Group Test of Learning Capacity - Intermediate Form consists of 70 items. The test provides an overall measure of mental ability expressed in I.Q. terms.

Procedure

All pupils attending grades 7 and 8 received the Institute of Child Study Security Test, the Canadian Tests of Basic Skills, and the Frymier Junior Index of Motivation during a three-week period in January, 1974. The Dominion Group Test of Learning Capacity was administered to all grade 7 and 8 pupils in December, 1973. The home room teachers completed the Pupil Rating Scale the last week of January, 1974.

A total of 210 out of 240 pupils attending grades 7 and 8 were included in the study and for whom data were available in 1971-72. Twenty-six pupils were new to the school in 1973-74, and four pupils were excluded because of incomplete data, either in 1971-72 or in 1973-74. Data which were available in 1971-72 included the scores on the Institute of Child Study Security Test, four subtests of the Canadian Tests of Basic Skills and Pupil Rating Scores.

All tests given in 1973-74 were administered by the Principal of the school. The Institute of Child Study Security Test and the Canadian Tests of Basic Skills were machine scored and the Frymier Junior Tndex of Motivation was hand scored. All data were analyzed by computer.

C. Results and Discussion

The mean scores obtained for grade 7 and grade 8 pupils on security, consistency and independence as measured by the Institute of Child Study Security Test are shown in Tables 2 and 3. These means are reported for January, 1972 and January, 1974. The F ratios obtained by a one-way analysis of variance compared sex differences for open and traditional classrooms separately. The last column in each table showed a sex by school interaction employing a two-way analysis of variance.

The results for grade 7 pupils showed no significant differences for any of three security test variables for either boys or girls when open space and traditional classroom comparisons were carried out. However, the results did show marked differences, favouring girls, for security, consistency and independence when boys and girls who had previous attendance in open space classrooms were compared. These differences were only slight in 1972 but became significantly larger in 1974. Figure 1 shows a deceleration in growth for boys who were previously in open space classrooms for all three security test variables when compared to girls and when compared to boys and girls from traditional classrooms. Moreover, the size of increase in consistency scores for girls from

Table 2

Means and F Ratios for Grade 7 Pupils

Variable		Means: Open Boy	Means: Open Girl	Means: Traditional Boy	Means: Traditional Girl	One-way analysis: Open B/G	One-way analysis: Trad. B/G	One-way analysis: Boy O/T	One-way analysis: Girl O/T	Two-way analysis: Sex x Sch.
	Jan.	(46)	(32)	(25)	(15)					
Sec.	'74	70.97	78.88	72.84	73.88	10.07**	0.05	0.33	2.41	2.04
Cons.	'74	29.00	45.22	34.06	37.11	16.60***	0.19	1.13	2.07	3.09
I S	'74	32.50	28.22	31.56	31.47	6.48*	0.00	0.24	2.00	1.78
	Jan.									
Sec.	'72	66.77	69.11	63.88	66.44	0.49	0.27	0.75	0.27	0.00
Cons.	'72	25.09	33.89	22.06	30.08	4.54*	1.52	0.44	0.42	0.01
I S	'72	35.50	32.94	37.44	35.87	1.66	0.22	0.82	0.85	1.78

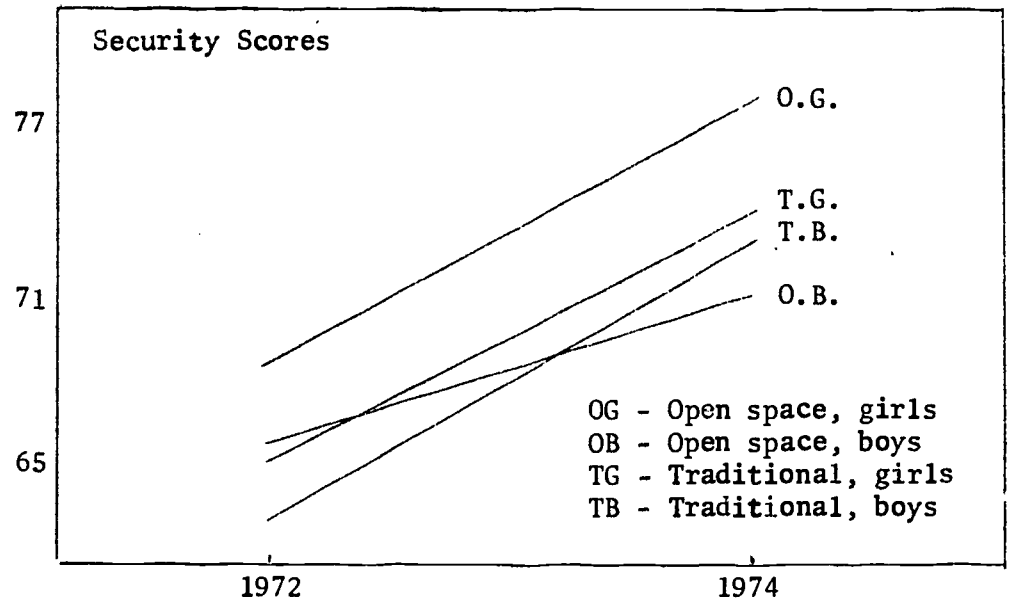
* < .05
** < .01
*** < .001

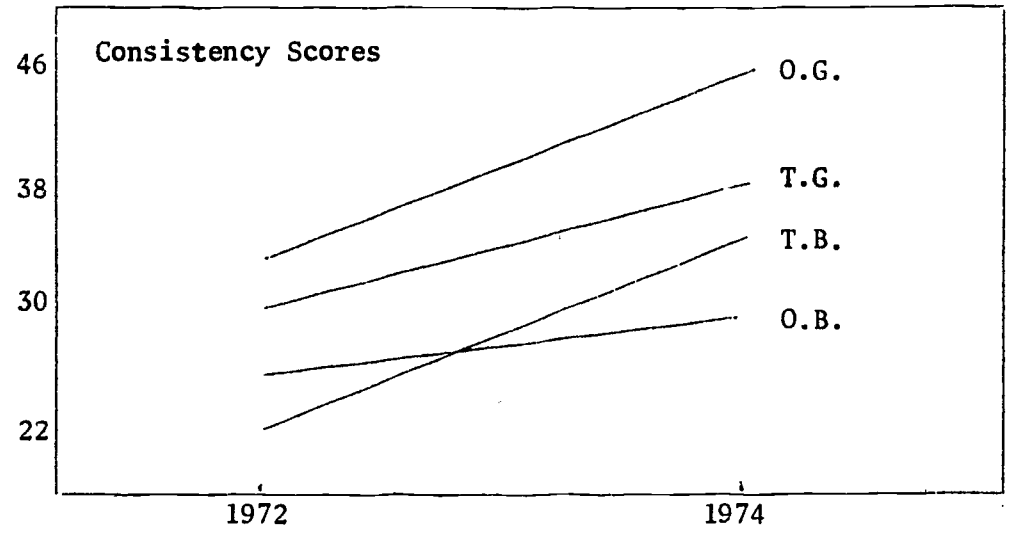
Table 3

Means and F Ratios for Grade 8 Pupils

Variable		Means: Open Boy	Means: Open Girl	Means: Traditional Boy	Means: Traditional Girl	One-way analysis: Open B/G	One-way analysis: Trad. B/G	One-way analysis: Boy O/T	One-way analysis: Girl O/T	Two-way analysis: Sex x Sch.
	Jan.	(23)	(25)	(17)	(27)					
Sec.	'74	78.50	76.68	76.24	84.64	0.31	8.31**	0.37	9.23**	5.36*
Cons.	'74	41.62	43.46	42.39	57.38	0.13	10.38**	0.02	12.60***	3.53
I S	'74	27.91	28.60	29.18	23.48	0.09	7.40**	0.25	7.42**	4.28*
	Jan.									
Sec.	'72	70.18	68.88	72.46	80.87	0.07	7.12*	0.19	10.82**	2.47
Cons.	'72	32.51	35.27	35.00	50.47	0.28	7.19*	0.15	10.68**	2.66
I S	'72	33.09	32.12	31.59	25.93	0.08	7.66**	0.18	7.24**	1.33

* < .05
** < .01
*** < .001





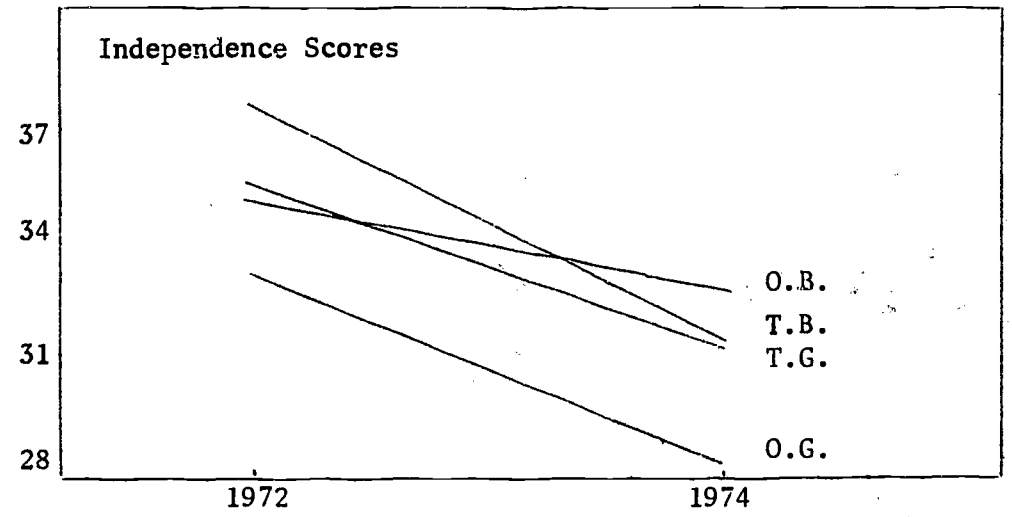


Figure 1: Means for three security measures obtained in 1972 and 1974 for Grade 7 pupils.

open space classrooms is significantly greater than the size of increase for boys from open space, $F(1,76) = 5.98$, $p < .02$, and boys from traditional classrooms show a significantly larger improvement in consistency scores to boys from open space classrooms, $F(1,69) = 4.70$, $p < .05$.

La Forge (1972) and McCallum (1971) obtained no significant differences for either personality variables or incidence of school problems for pupils attending open space and traditional schools, however, no sex comparisons were made in either study. On the other hand, Sackett (1971) using a Self-Esteem Inventory, found grade 6 pupils from an open space school performed significantly below that of pupils from two conventional schools.

The results of this study would strongly suggest that sex comparisons be included in future research on open space schools since this may be an important variable. It would seem from the present data on security development, that open space schools may have some negative effect on boys but shows no effect for girls. Since consistency scores reflect a measure of organizational ability and work habits (Grapko, 1955), it would seem that open space classrooms have a particularly poor effect on the work habits of boys. Since no data were collected in 1973 on this group of children, it is problematic as to whether the trend began to take effect when the pupils were in grade 6. There appear to be several explanations for these results. The first explanation is that boys are less able to adapt to a change in classroom structure than girls and consequently do not maintain the pace in their overall security development. In other words, there is a tendency for boys to slow up in their development when exposed to a change in environment.[4] The second explanation is that boys express a stronger emotional resistance to change in environments reflecting a tendency toward maintaining a more immature response. In some respects, it may be similar to pouting where displeasure is being expressed. McPartland (1972) found no differences between pupils' attitudes to grade 7 for children who previously attended an open space or traditional structured school. Unfortunately again, no sex comparisons were made in the study.

A third explanation for these results may be found in the classical frustration-regression hypothesis of Barker, Dembo and Lewin (1941). If boys are more highly attracted to open space settings because of the increased freedom and mobility that is offered, it is feasible that boys experience greater frus-

4. It is hoped that a follow-up of grade 7 pupils in this study in 1975 would show whether this trend for boys from open space classrooms corrects itself or whether the reduction in pace in security development is sustained.

tration than girls when they are removed from this situation. Since it would be difficult for boys to react aggressively to frustration in a classroom situation (Miller, 1941), a regressive response may arise. Accordingly, the regression for boys in this case is not so much a matter of reverting to responses typical of a more immature level of development, but rather a slow-up to the normal pace of development.

Still a further explanation for these data may be found in theories related to attachment, dependency and separation anxiety (Maccoby and Masters, 1970). It may be argued that boys become more intensely attached to open space environments for the reasons stated above, and that a change in environments brings about an increase in dependency and manifestations of separation anxiety. The significant reduction in independence and security scores for grade 7 boys from the open space setting would give some support for these hypotheses.

The results for grade 8 pupils are shown in Table 3 and Figure 2. Clearly, these results show the girls from the traditional school to be superior in their security development to boys, and to both boys and girls from the open space classrooms. However, this superiority was noted in 1972 and was maintained in 1974. Figure 2 shows the trend in security development to be fairly similar for both boys and girls from both classroom environments. However, the pace in security development during the two year period is more accelerated for both boys and girls from open space classrooms, particularly for security scores and less so for independence scores. While the size of increase for security and consistency scores in the two year period is larger for boys and girls from open space classrooms, the difference in size of increase is not statistically significant.

The two interaction effects between sex of pupil and classroom setting for security scores and independence scores suggests that, for grade 8 pupils, the boys from open space do slightly better than girls from open space; whereas boys from traditional classrooms do less well than girls. This result is opposite to the finding reported for grade 7 pupils where it was shown that boys from open space classrooms showed the smallest increases in security measures during the two year period. It is interesting to note that for security scores the slope of the line for grade 7 boys from open space is identical to the slope for grade 8 boys from traditional classrooms, and conversely, the slope for grade 7 boys from traditional classrooms is identical to the slope for grade 8 boys from open space classrooms.

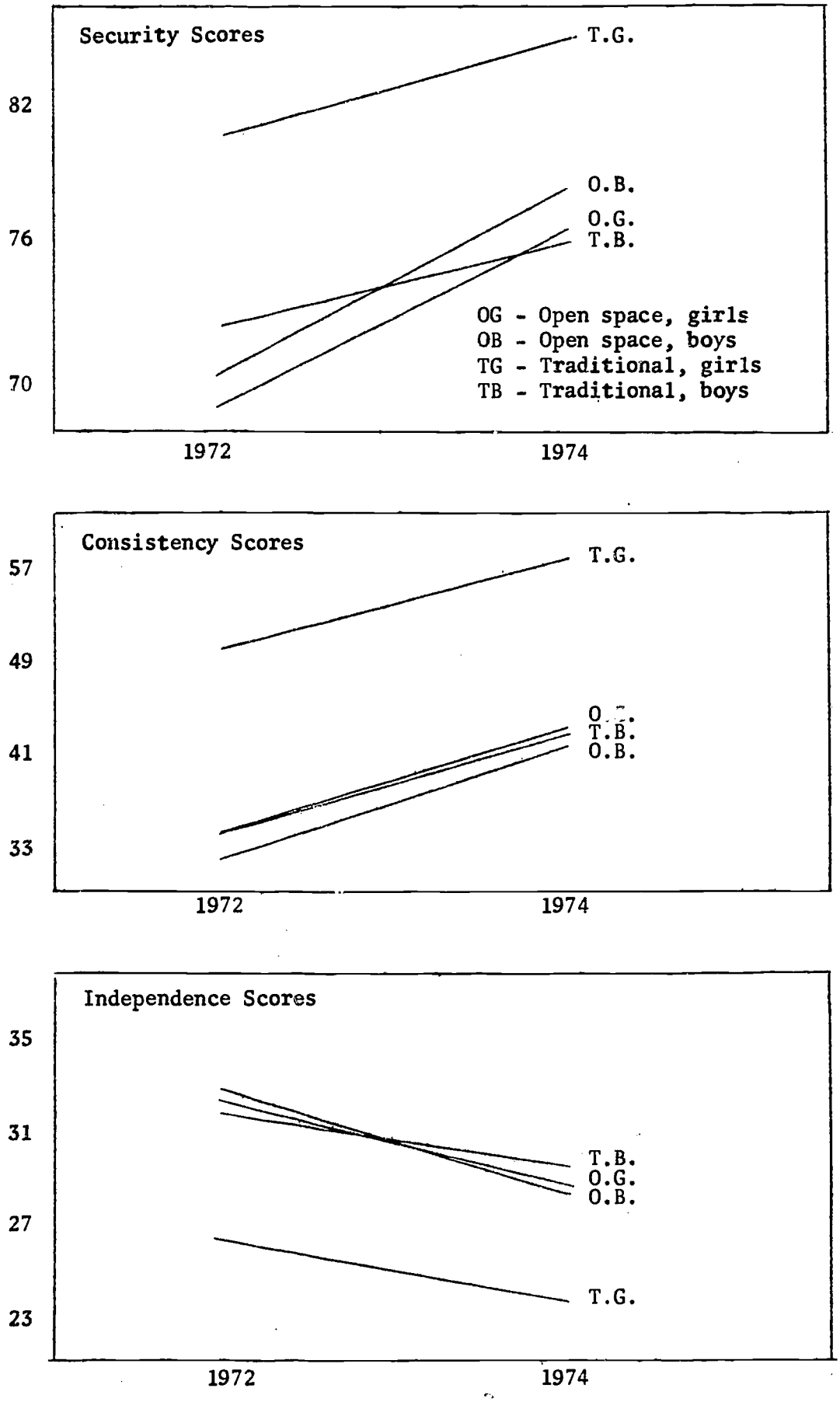


Figure 2 - Means for three security measures obtained in 1972 and 1974 for grade 8 pupils.

The explanation for these results may be inherent in composition differences for the two groups of boys in the study. The grade 7 boys from open space classrooms show to be significantly different to boys from traditional classrooms on a number of other variables included in the study. For example, the mean I.Q. scores for the two groups of grade 7 boys are 100.02 and 106.88 respectively; $F(1,69) = 3.63$, $p > .05$. Statistically significant differences are obtained for three of the six CTBS tests and for average marks on December examinations, $F(1,69) = 6.23$, $p < .01$, and March examinations, $F(1,69) = 5.58$, $p < .02$. The average pupil rating scores as rated by the classroom teachers shows a significant higher overall rating for the boys from traditional classrooms as well, $F(1,69) = 4.31$, $p < .05$.[5] On the other hand, no significant differences are reported for grade 8 boys from open space and traditional classrooms for I.Q., CTBS test scores, December and March examinations or pupil rating scores.

Since the grade 8 pupils from open space classrooms were back in a traditional school for their second year, the results may suggest a fadeout effect of open space instruction on children's security development.

The size of increase in security scores for both boys and girls from open space shows a catch up effect from 1972 to 1974. Whereas a significant difference in mean security scores was shown between the grade 8 pupils from open space and traditional classrooms in 1972, $F(2,90) = 5.34$, $p < .02$, the difference in security scores is no longer significant in 1974. Whether the grade 7 boys and girls from open space classrooms would show similar gains in security scores during their second year in a traditional school is yet to be shown; however, these data would add to clarify the question of a fade-out effect. At the present time, it is unclear as to whether a possible fade-out effect applies more directly to boys from open space classrooms, or may apply to both boys and girls.

Tables 4 and 5 show the mean scores for six of the subtests of the Canadian Tests of Basic Skills (CTBS) obtained in January, 1974, and the mean scores for four subtests of the CTBS obtained in 1973[6] (grade 7 pupils) and 1972 (grade 8 pupils). The statistical analysis of these data show rather different results for the grade 7 and grade 8 pupils. For grade 7 pupils, the performance of boys from traditional classrooms excels the performance of boys from open space. These differences in performance are also shown in 1973.

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5. As shown in Tables 2 and 3, no significant differences are noted for any of the three security measures in 1974 between boys in open space and traditional classrooms, nor are any significant differences shown between boys in grade 8 from the two school settings.

6. The CTBS was not administered to grade 5 pupils attending open space classrooms in January, 1972. However, CTBS data were available for all grade 7 pupils in this study while attending grade 6 in January, 1973.

Table 4

CTBS Means and F Ratios for Grade 7 Pupils

Variable	Means				One-way Analysis				Two-way Analysis
	Open		Traditional		Open	Trad.	Boy	Girl	Sex x Sch.
	Boy	Girl	Boy	Girl	B/G	B/G	O/T	O/T	
	(46)	(32)	(25)	(15)					
Reading '74	34.41	42.75	42.28	40.87	8.09**	0.13	6.49*	0.23	3.82*
Spelling	19.26	25.09	23.72	27.27	8.01**	1.79	4.18*	0.66	0.44
Usage	16.22	19.63	18.48	20.27	9.03**	1.90	3.74	0.21	0.77
Reference	26.70	31.03	30.72	31.47	4.15*	0.06	3.10	0.02	0.94
Math. Conc.	18.30	20.34	22.56	20.47	1.89	0.97	6.66*	0.00	2.55
Math. Prob.	12.41	12.66	14.12	13.67	0.05	0.08	2.15	0.47	0.14
Reading '73	33.89	40.47	41.21	37.27	5.47*	1.09	5.65*	0.78	4.80*
Vocabulary	21.69	23.63	26.92	22.27	0.88	3.42	5.69*	0.27	3.68
Math. Conc.	21.73	24.63	27.63	24.20	2.65	1.89	8.31*	0.04	4.22*
Math. Prob.	14.22	15.44	17.38	16.40	1.11	0.23	6.31*	0.27	1.02

* < .05
** < .01
*** < .001

Table 5

CTBS Means and F Ratios for Grade 8 Pupils

Variable	Means				One-way Analysis				Two-way Analysis
	Open		Traditional		Open	Trad.	Boy	Girl	Sex x Sch.
	Boy	Girl	Boy	Girl	B/G	B/G	O/T	O/T	
	(23)	(25)	(17)	(27)					
Reading '74	45.22	47.64	46.12	46.96	0.48	0.03	0.04	0.03	0.08
Spelling	23.83	26.92	25.41	30.93	1.04	4.06*	0.27	2.14	0.34
Usage	15.04	16.16	14.24	17.07	1.06	4.75*	0.43	0.65	1.05
Reference	26.13	31.64	29.82	31.78	4.75*	0.37	2.11	0.00	0.77
Math. Conc.	23.61	23.88	22.77	22.33	0.02	0.03	0.15	0.61	0.06
Math. Prob.	15.39	16.00	16.06	15.44	0.23	0.17	0.27	0.16	0.39
Reading '72	38.44	41.96	43.64	43.81	1.50	0.00	1.81	0.38	0.48
Vocabulary	24.17	25.00	26.00	26.08	0.15	0.00	0.51	0.20	0.04
Math. Conc.	25.22	25.32	28.29	24.42	0.00	2.80	2.06	0.28	2.16
Math. Prob.	14.87	15.96	17.43	16.39	0.59	0.49	3.32	0.09	1.05

* < .05
** < .01
*** < .001

The findings for grade 7 pupils can be interpreted to suggest that any effect of the open space school on academic performance is more likely to be evident for boys than for girls, and that boys attending open space classrooms will likely perform less well than boys from traditional classrooms.

In the case of grade 8 pupils, no significant difference in CTBS performance is noted for either boys or girls from open space and traditional classrooms in 1972 or 1974.

A comparison of performance measures for the CTBS between boys and girls shows that girls do better than boys in both grade 7 and grade 8. However, the grade 7 results show the girls to do significantly better than boys who come from open space classrooms, whereas no significant differences are noted between boys and girls whose background has been in traditional classrooms. While the grade 8 results also show girls to excel over boys on the CTBS, these differences are limited to fewer subtests, and apply to both the open space and traditional classroom settings alike. Without regard for school setting, girls do significantly better than boys in both grade 7 and grade 8 on Spelling: $F\ (2,116) = 7.32$, $p < .01$; $F\ (2,90) = 4.35$, $p < .05$, respectively, and Language Usage, $F\ (2,116) = 7.89$, $p < .01$; $F\ (2,90) = 5.51$, $p < .02$, respectively. Contrary to expectation, there are no significant differences in performance on the two Mathematics subtests between boys and girls for either grade 7 or grade 8. The belief that boys are generally better in Mathematics than girls is not supported by the results of this study, at least to the end of the grade 8 level.

The Mathematics Concepts and Mathematics Problem Solving scores obtained for grade 7 boys, however, does show that boys from traditional classrooms excel over boys from open space classrooms in these two academic skills in 1973, and to a lesser extent in 1974. It is also noted that an interaction effect between sex of pupil and school setting is shown in 1973 for Mathematics Concepts, however, the effect is washed out a year later. While the differences are not statistically significant, a similar trend is observed between grade 8 boys from open space and traditional classrooms in respect to the two Mathematics skills. Grade 8 boys from traditional classrooms show a clear mean advantage on the two Math skills over grade 8 boys from open space in 1972, but the mean differences almost disappear in 1974. In the case of Math Concepts, boys from open space actually overtake the boys from traditional classrooms in 1974.

When the raw scores are converted to grade level equivalents, Figures 3 and 4 show growth trends for three of the performance subtests on the CTBS. Figure 3 shows growth in Reading Comprehension for grade 7 pupils to be slower for boys

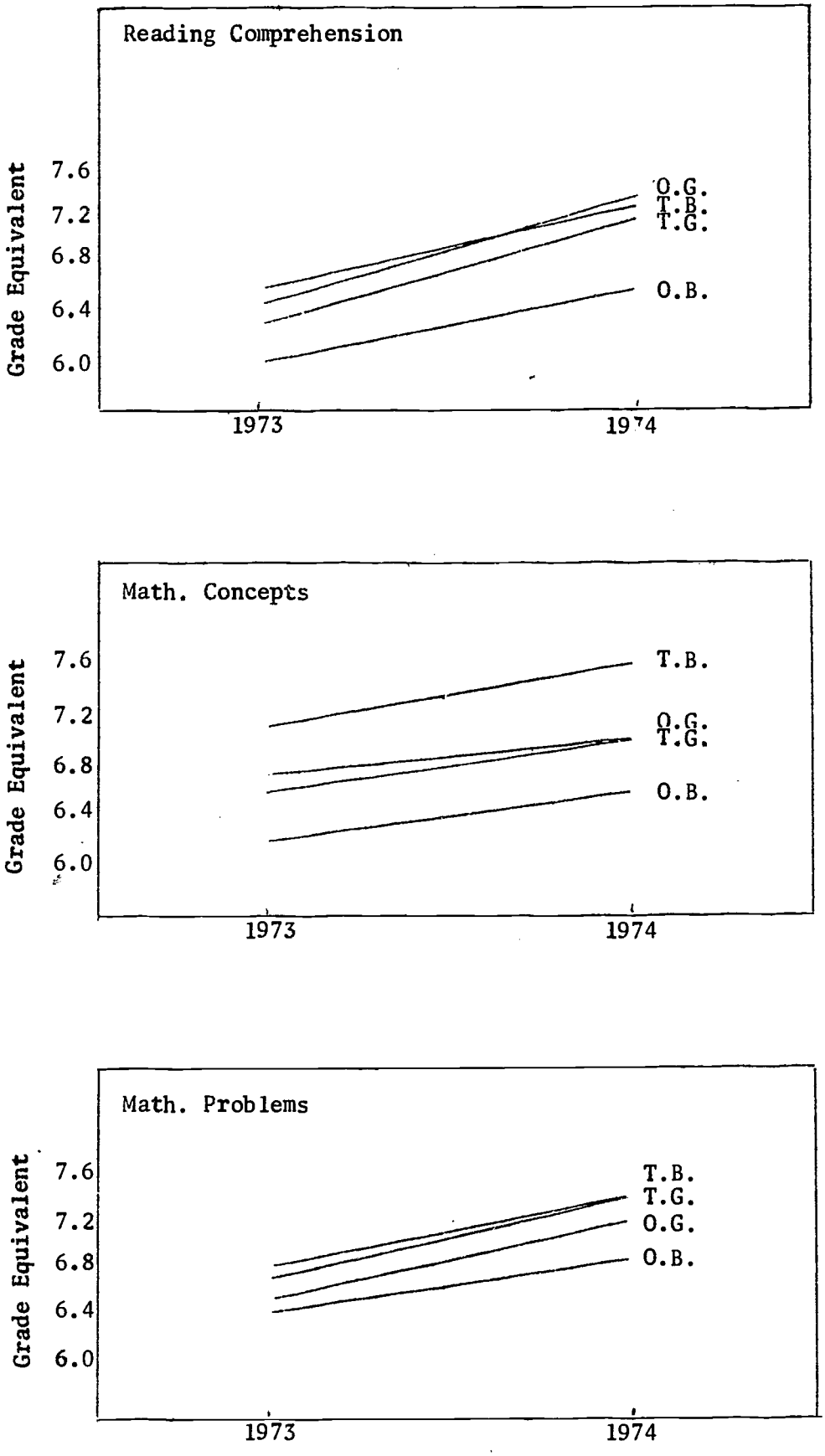

Figure 3 - CTBS grade equivalents obtained in 1973 and 1974 for grade 7 pupils.

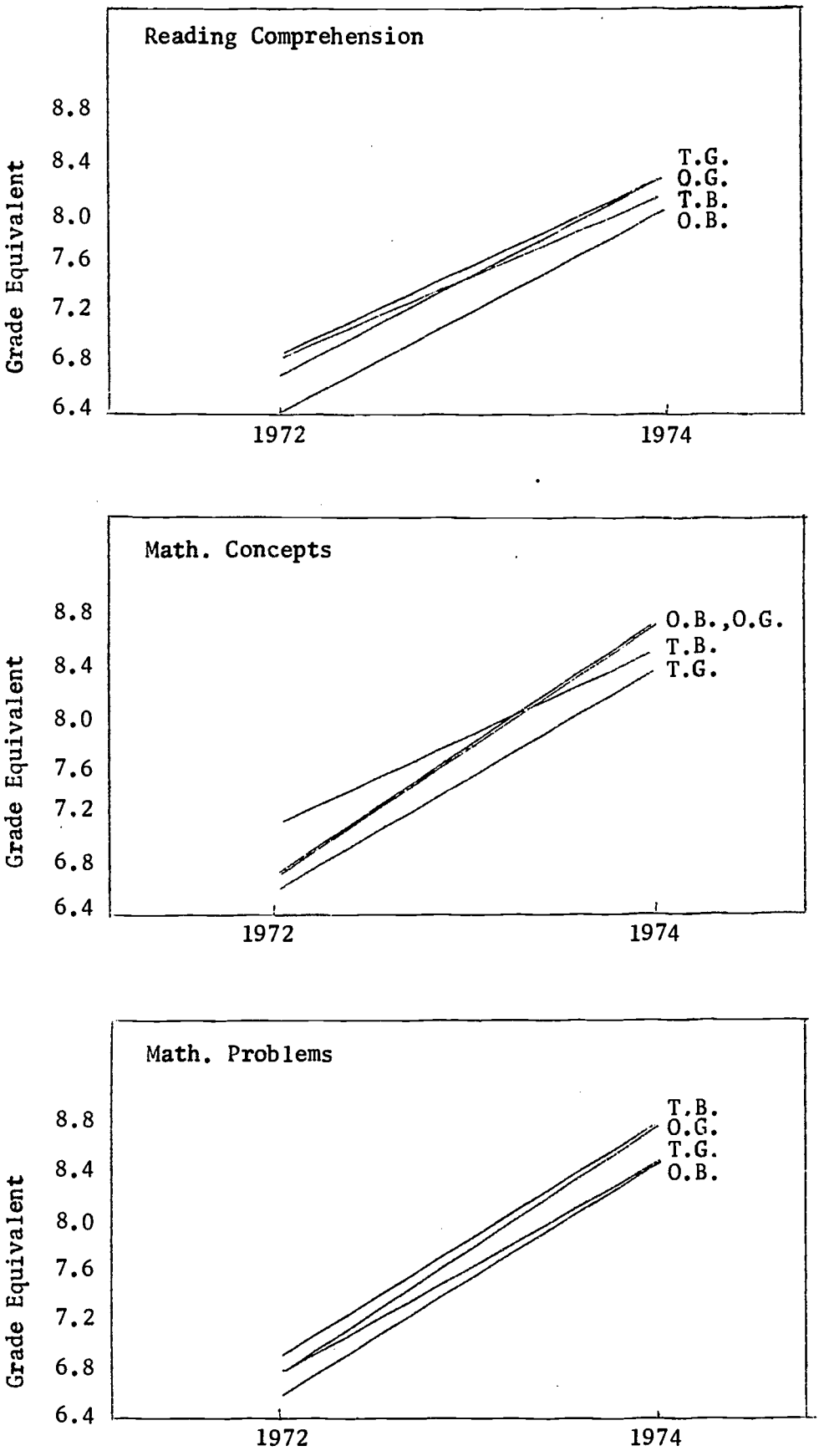

Figure 4 - CTBS grade equivalents obtained in 1972 and 1974 for grade 8 pupils.

than for girls from January, 1973 to January, 1974. For grade 8 pupils, the trend shows a similar slow-up effect for boys from traditional classrooms, whereas the boys from the open space setting show a growth trend similar to girls.

For the two Mathematics subtests, the grade 7 boys and girls from open space and traditional classrooms show similar growth trends between 1973 and 1974 with only minor variation. For grade 8 pupils, boys and girls from open space classrooms show a marked acceleration between 1972 and 1974 on the Mathematics Concepts in comparison to pupils from traditional classrooms. These data would suggest a substantial catch-up effect for pupils who had previously attended an open space school. The same catch-up effect is not shown for the Mathematics Problem Solving subtest.

While no differences are reported in Reading Comprehension between boys and girls or between open space and traditional classroom settings for grade 8 pupils in 1972 or 1974, an interesting interaction effect between sex and school is noted for grade 7 pupils in both 1973 and 1974. This result suggests that girls who come from open space settings are likely to achieve higher Reading Comprehension scores, while boys achieve higher Reading Comprehension scores if they come from traditional classroom settings.

Moodie (1971) using the Gates-MacGinite Reading Test obtained scores for pupils while in grade 7 and a year later in grade 8 and found grade 7 pupils from open area classrooms to perform lower on Reading achievement than grade 7 pupils in conventional classrooms. However, the differences in mean scores disappeared when the pupils were retested in grade 8 . MacRae (1970) also using the Gates-MacGinite Reading Test, tested two groups of students entering grade 9 and found the group from open space classrooms to score significantly lower on speed and accuracy, vocabulary, and comprehension than the group from traditional classrooms. Again, no sex comparisons were carried out.

The results of the present study generally agree with the above findings, however it does seem from the present data that Reading Comprehension deficits are most likely to be observed for grade 7 boys who had attended open space classrooms. Since there appears to be a difference in the composition of grade 7 and grade 8 pupils in the present study, it would be desirable to retest the grade 7 pupils in 1975 to determine if there is in fact a catch-up effect in Reading and other basic skills when these pupils reach grade 8, or whether the deficit for grade 7 boys remains.

Academic marks received by grade 7 and grade 8 pupils based on December and March reports were averaged and the means for boys and girls from each school setting are reported in Tables 6 and 7.[7]

Means for each group are also shown for I.Q., pupil rating scores obtained in 1972 and 1974, and Motivation for school (JIM scale).

A comparison of means for December and March subject scores for grade 7 pupils shows a pattern of results similar to results obtained for the CTBS data.[8] The grade 7 boys from open space classrooms show to have the lowest average marks in December, 1973 and March, 1974 when compared to boys from traditional classrooms and when compared to girls from open space and traditional classrooms. The position of the 46 boys in grade 7 from the open space setting is consistently low for almost all of the data comparisons carried out in this study. It should be noted that there are ten to thirteen boys from open space classrooms in each of the four grade 7 classes in the school, and accordingly make up about a third of the size of each of the four classes.

No academic performance data were available for these boys in 1972, first because no formal school tests were administered to the grade 5 pupils in the open space school, and secondly the CTBS was not yet introduced as part of a general test program in the school. However, since the grade 7 girls from the open space classrooms do as well as pupils from traditional classrooms, the effect of the open space setting on academic performance appears clearly to work against boys only. Whether the explanation for these results is similar to the explanation given to account for a deceleration in security development remains in question. While several writers have described the positive features of open space schools and open education (Anderson, 1970; Barth, 1970; Beardsley, 1973; Gomolak, 1971; Hodkey, 1969; Marshall, 1972; Wilen, 1972; Meyer, 1971; Ledbetter, 1969; Lynch, 1972; Matheson, 1970; Myers, 1971), there have been few writers who have pointed out some disadvantages (Anderson, 1972; Frazier, 1972; Fullan, 1971; Kyzar, 1971; Stolee, 1970). Notable among the comments listing the disadvantages are visual and auditory distractions, the warehouse appearance, lack of effective interaction among teachers, the lack of facilities, the absence of clearly defined areas, the fish bowl phenomenon and the view that open space schools are "educational bazaars".

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7. The marks assigned in December and March were based on formal tests and daily work assignments and included eleven subject areas, namely oral reading (50), literature (100), spelling (50), composition and creative writing (100), handwriting (50), grammar (50), history (100), geography (100), science (100), mathematics (100), and industrial arts or home economics (100). Art, music, physical education and French were letter graded and not included in the average. The maximum marks assigned to each of the eleven subjects is shown in brackets.

8. The product-moment correlation coefficients between CTBS scores and examination marks range from the low to high 70's.

Table 6

Means and F Ratios for Grade 7 Pupils

Variable		Means				One-way Analysis				Two-way Analysis
		Open		Traditional		Open	Trad.	Boy	Girl	Sex x Sch
		Boy	Girl	Boy	Girl	B/G	B/G	O/T	O/T	
		(46)	(32)	(25)	(15)					
December Tests	1973	61.72	69.26	68.03	69.25	9.31**	0.29	6.23*	0.00	2.69
March Tests	1974	60.98	69.94	66.80	68.00	12.98***	0.22	5.58*	0.39	3.83
T.R.	Jan/74	28.22	36.59	34.00	34.53	9.59**	0.03	4.31*	0.39	3.22
T.R.	Jan/72	84.91	93.81	77.68	84.93	2.54	1.06	1.38	1.82	0.03
I.Q.	1974	100.02	105.59	106.88	102.67	3.09	0.84	3.63	0.53	3.11
JIM Scores	1974	113.02	123.59	122.12	119.53	4.05*	0.14	2.86	0.31	2.17

* < .05
** < .01
*** < .001

Table 7

Means and F Ratios for Grade 8 Pupils

Variable		Means				One-way Analysis				Two-way Analysis
		Open		Traditional		Open	Trad.	Boy	Girl	Sex x Sch.
		Boy	Girl	Boy	Girl	B/G	B/G	O/T	O/T	
		(23)	(25)	(17)	(27)					
December Tests	1973	67.82	73.45	65.15	68.86	6.03*	1.73	1.04	3.56	0.28
March Tests	1974	67.78	70.56	65.35	66.59	1.60	0.17	0.98	2.33	0.18
T.R.	Jan/74	29.65	36.88	30.41	31.70	5.83*	0.13	0.05	3.09	1.66
T.R.	Jan/72	83.83	85.92	87.53	87.04	0.19	0.00	0.32	0.04	0.09
I.Q.	1974	104.74	111.44	105.94	106.78	4.27*	0.03	0.10	1.30	1.06
JIM Scores	1974	122.22	127.52	123.71	129.11	0.79	0.59	0.04	0.07	0.00

* < .05
** < .01
*** < .001

While the list of advantages of open space schools far outstrip the list of disadvantages, it may be that boys rather than girls react unduly to the apparent hazards of open space. Research on selective attention or attention and distractability does not provide any data which might suggest that boys are more inclined to be distractable than girls (Pick and Pick, 1970). The separation effect resulting from an attachment which a pupil may have for a particular school may create a greater anxiety in boys than girls, which may cause boys to show a deficit in academic performance. The literature on attachment, dependency and separation anxiety, however, fails to deal with the later school age child and no clear sex differences are reported (Macoby and Masters, 1970). If in fact boys become more attached to open space schools than girls, it is possible that a displacement to a new school environment, presumably one which is less attractive in appearance and concept, may create a higher level of frustration in boys which may lead to aggressive or regressive behaviours. Since aggressive behaviours toward the traditional school are likely to be inappropriate, boys may show a displacement for their aggression, expressing low motivation for school and low interest in academic subjects.

There is a significant difference between grade 8 boys and girls from open space classrooms when compared for marks on the December results, but this difference is not significant for marks reported in March. It seems that this result is due to an overall reduction in average marks for girls rather than an increase in average marks for boys. In the case of grade 8 girls from both open space and traditional settings, the average marks received in March, 1974 represent at least a 2 percent drop from marks received in December, 1973; whereas for boys there is practically no change. This pattern is not shown for the grade 7 classes. Whether these data show the beginning of a period of catch-up between boys and girls for academic performance remains to be explored further.

The rating of pupils by teachers in January, 1974 shows a clear advantage to girls over boys for both grade 7 and grade 8 classes, and in particular this result is significant for pupils from the open space setting. These data are consistent with data obtained for security development, academic performance measures (CTBS) and academic marks. Since the Pupil Rating Scale includes both performance and behavioural traits, this result adds to the internal consistency of data collected for the pupils in this study.

The results of the teacher ratings obtained in January, 1972 are less consistent with the general trends established from other sources of data input in

this study.[9] However, no significant differences are shown for any of the comparisons between sexes or between schools for either grade 7 or grade 8 pupils.

The mean I.Q. scores obtained for grade 7 and grade 8 boys and girls from open space and traditional schools are group test results. Overall, the pupils in this study show an average intelligence in the upper half of the normal range. On average the grade 8 pupils are about 3.5 I.Q. points higher than grade 7 pupils, i.e. 107.2 and 103.8 respectively. No significant statistical differences in mean I.Q. scores are shown for grade 7 pupils when compared for sex and school. Analysis of I.Q. data for grade 8 pupils, however, does show girls to be more intelligent as a group than the boys from open space settings. It has been noted already that grade 8 girls also excel over grade 8 boys from open space classrooms in respect to marks received in December and the mean teacher rating scores. The correlation coefficients for I.Q., report marks, and teacher ratings are mostly in the mid-70's. Similar coefficients are shown for the results of the CTBS and the three variables mentioned above. These results provide concurrent validity for each of the four separate measures employed.

The interpretation of results for the Frymier Junior Index of Motivation (JIM) is equivocal in view of preliminary norms developed by Frymier (1970). Based on approximately 500 grade 7 pupils, Frymier's results show that girls score higher than boys on the JIM scale, i.e. 115.44 for boys, and 124.06 for girls. Grade 8 norms based on a similar number of cases show means of 117.24 for boys and 125.02 for girls.

Using the norms as a baseline, it would seem that boys from traditional classrooms show the highest motivation to do well at school, exceeding the norm means by 6.68 and 5.97 for grade 7 and grade 8, respectively. The result is partly opposed to findings by Wilson (1969) and Matheson (1970) who report that pupils from open space schools show more positive attitudes to school and are generally better motivated to do well academically. It is noted, however, that the grade 7 girls from the traditional school setting show the lowest performance on the JIM scale, compared to the norms provided for grade 7 pupils. Grade 8 pupils from open space and traditional school settings used in this study exceed the norms for grade 8 pupils for both boys and girls. According to the results of the JIM scale, it would seem that all grade 8 pupils in this study are motivated to do good work in school. In a preliminary study, Frymier (1970) found JIM scale scores for grade 7 pupils to relate to achievement scores and I.Q. scores.

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9. The Pupil Rating Scale in 1972 included 14 traits whereas the PRS in 1974 was reduced to 6 traits. The reported means show the total combined rating received for all traits.

In the present study, the correlations between JIM scale scores and Reading Comprehension (CTBS) and I.Q. are .51, $p < .001$ and .42, $p < .001$ respectively. December and March report marks correlate with JIM scale scores, showing coefficients of .41, $p < .001$ and .44, $p < .001$ respectively. It would seem from these results that the children's motivation to do good work in school is clearly reflected in better academic performance in school and that motivation for school is perhaps more a function of I.Q. than the particular school setting a child may be attending. It is also noted that the correlation coefficients are all statistically significant between JIM Scale scores and academic performance and I.Q. for grade 8 pupils in this study, i.e. .47, $p < .001$ (Reading Comprehension, CTBS), .32, $p < .01$ (I.Q.), .39, $p < .001$ (December report marks), and .42, $p < .001$ (March report marks).

Since the Consistency Scores derived from the Security Test purport to measure organizational skills and good work habits (Grapko, 1955), it may be expected that these scores would show a significant degree of relationship to the child's motivation for school. The correlation coefficients between Consistency Scores and JIM Scale scores for grade 7 and grade 8 pupils are .45, $p < .001$ and .40, $p < .001$ respectively. Also since teachers are likely to rate children favourably who are motivated to do good work in school, it is expected that a significant relationship would exist between these variables. The correlation coefficients between JIM Scale scores and scores for January, 1974 on the Pupil Rating Scale for grade 7 and grade 8 pupils, respectively, are .39, $p < .001$, and .43, $p < .001$.

D. Conclusions

Some conclusions may be tentatively drawn from the results of this study. In the first place, it would appear that grade 7 boys who had previously attended an open space school show the effects of open space most clearly. When these boys attended grade 5 in the open space school, their academic performance was significantly lower, when compared to a group of grade 5 boys who were attending a traditional school. Two years later, when all the boys were attending the same school for the first time (i.e. traditionally built school), the grade 7 boys who had come from the open space school still continued to perform significantly lower on academic performance tests. Moreover, their school marks obtained in grade 7 were also significantly

lower when compared to the grade 7 boys from the traditional school. The results of this study agree with the findings reported by McRae (1970) and Townsend (1971).[10]

While the security measures for the two groups of grade 7 boys were not significantly different either in 1972 or 1974, the growth in security and consistency during the two year interval was significantly slower for the grade 7 boys from the open space school. Furthermore, the teachers' assessments of the four classes of grade 7 pupils in 1974, showed significantly lower ratings given to the boys from open space in comparison to boys who were continuing in the traditional school.

Secondly, a comparison between the grade 7 boys and girls from the open space school shows the girls to gain significantly over the boys during the two-year period from 1972 to 1974, particularly for the three security measures and the teacher assessments of pupils. A comparison of grade 7 boys and girls from the traditional school shows no such sex differences. It may be concluded from the grade 7 results that any effect which may be attributed to the open space school is most likely to disable the boys and have little, if any, impact on girls. Several explanations for this result have been proposed.

The effect of the open space school based on the data collected for grade 8 pupils is less clear. A comparison between the grade 8 boys from open space

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10. While these data support the conclusion that the open space school may have a negative effect on the academic performance of boys, and that this effect begins to appear at least by the 5th grade, the findings do not exclude the probable effect of variables which were not controlled in the study. The selection of a small town for the study attempted to reduce any large socioeconomic effect on the data collected, as well as to reduce the problems associated with sampling. The teachers were invited to join the staff of the open space school when it opened in 1970, however, there were no special qualifications required for teachers who were chosen, nor was there any reason to believe that the quality of teaching or the dedication of the teachers to the program was significantly different to the teachers who taught at the traditionally built school. The program at the open space school did permit more variable grouping of pupils, required more collaboration among the teachers, particularly among those who taught at the same grade level, and allowed children more freedom to work on their own and freedom to use the resources of the school.

    The teachers who joined the staff of the open space school were, for the most part, in an open space school for the first time, and undoubtedly faced some problems in adjusting to the physical layout of the school. The extent to which these variables, or others unspecified, may account for the findings obtained in this study is not known.

and grade 8 boys from the traditional school shows no significant differences on any of the variables examined, either in 1972 when the pupils were in grade 6, or in 1974 when all pupils were attending grade 8 in the traditional school. This result could be attributed to differences in the make-up of the grade 7 and grade 8 classes. However, it is also noted that some of the grade 8 pupils in the study had one less year in the open space school, as well as being in their second year in the traditional school when the 1974 data were gathered. Whether the extra year in the traditional school for the grade 8 boys from the open space school accounts for these results is unanswered.[11]

Thirdly, while no differences were noted for any of the variables between the grade 7 girls from the open space and traditional schools, the results for grade 8 pupils show girls from the traditional school to achieve significantly higher security, consistency and independence scores than girls from the open space school, both in 1972 and 1974. In view of the trend in 1974 for girls from the open space school to be rated more favourably by their teachers, to have higher I.Q. scores, and to obtain higher marks on December and March term tests than the girls from the traditional school, the results of the security test seem all the more remarkable. The conclusion to be drawn from these data is by no means clear. The trend for grade 7 girls shows the girls from the open space school to excel over the girls from the traditional school for all three security measures, while the results for the grade 8 girls are exactly reversed. On the other hand, the amount of growth in each of the three security measures during the period 1972 to 1974 favours the girls from the open space school for both grade 7 and grade 8. This result suggests that girls show a greater improvement in their security development when they enter (or re-enter) a traditional school setting.

Fourthly, the data permit no conclusions to be reached regarding the effect of the open space school on pupil's motivation to do well in school. When the scores are adjusted according to the norms presented for boys and girls, there appears to be no evidence to suggest that pupils from open space express any more or any less interest in school. These results do not confirm the findings reported by Wilson (1969) and Matheson (1970).

Finally, teacher assessments of pupils show no preference given to pupils from either the open space or traditional school setting. The data do show, however, that teachers rate girls more favourably than boys and this result is shown for pupils in grade 7 and grade 8.

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11. A follow-up of grade 7 classes in January, 1975 could provide some clarification to this question.

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