SECONDARY SCHOOLS AND THE GROWTH OF INTELLECT

SOME CONSIDERATIONS FOR PLANNING

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ABSTRACT

A longitudinal study traced the intellectual growth exhibited by students across the secondary school years. The results indicate that students enter high school at different stages of intellectual development. There is a relationship between level of intellectual development at entry to secondary school and retention at school. More females than males enter secondary school at an intellectually immature stage and may leave school early. These findings are considered in the context of current challenges facing secondary education and an argument is developed in favour of curriculum developments which encourage school retention and promote intellectual maturity.

In 1973 the Minister for Education approved the following statement of aims for secondary education in New South Wales:

> The central aim of education, which, with home and community, the school pursues is to provide individual development, in the context of society, through recognisable stages of development towards perceptive understanding, mature judgement, responsible self-direction and moral autonomy.

This was a most interesting statement, adopting as it did a strongly developmental approach more often associated with early childhood education than with secondary education.

Notwithstanding this statement of aims and a similar policy enunciated by the United States Educational Policies Commission as early as 1961 (Educational Policies Commission, 1961), there has not been a penetrating analysis of the structure and content of secondary education to determine whether it is geared to facilitate such development. Indeed, Arons and Karplus (1976) were quite pessimistic about the possibility that American secondary education was at all influential in facilitating intellectual growth.

We do know, however, that all is not well in secondary education. Studies such as those by Connell *et al.* (1975) and Meade (1981) identify student dissatisfactions and the press maintains a fairly constant flow of criticism from employer groups and other interested parties. One consequence of disillusionment with conventional secondary education programmes has been the promotion of job training schemes and transition education schemes for adolescents not responding to, or not interested in, conventional schooling. A similar trend has occurred in the United States and some of the States have lowered, or have contemplated lowering, the compulsory school leaving age (Stipek, 1981).

Have we been defeatist in our attitude towards the problems facing secondary education and haphazard in our attempts to respond? Hobbs and Robinson (1982) write:

> The possibility of reforming secondary schools to nurture cognitive development seems not to have been sufficiently considered as a possible solution, probably because of the belief that by adolescent years, it is too late to make any difference in the development of cognitive competence. (p.214).

It is timely to examine the course of intellectual growth of Australian adolescents through the secondary school years. Such information may allow us to commence a more intensive examination and reconstruction of secondary education.

A LONGITUDINAL STUDY OF INTELLECTUAL DEVELOPMENT:

A survey undertaken in 1976 (Blake, 1977) indicated changes in level of intellectual development, as measured by Piagetian-style tasks, do occur over the years of secondary education. However, these results did not distinguish real growth in individuals from the effects of differential drop-out from school. Accordingly, a seven-year longitudinal study was commenced in order to seek answers to the following questions:

(a) Does intellectual development, as described by Piaget, occur in adolescents during the secondary school years?

/2

(b) If it does, is it a general phenomenon or is it confined to particular students?

(c) Is there a relationship between level of intellectual development and retention at school?

Procedures: Students from metropolitan Melbourne and from the Riverina region of New South Wales were employed in the study. Random samples of students in Years 7 and 8 were drawn in 1976 as follows:

53 Riverina Year 7 students
51 Melbourne Year 7 students
60 Melbourne Year 8 students
164 Total

These students were regularly interviewed using a battery of Piagetian tasks to determine levels of intellectual development. A complete description of the testing schedule and task administration procedures is provided in the full report of the study (Blake, 1983). It is sufficient to note here that students were tested several times during their years at school with a battery composed of the following tasks administered in clinical interview.

Task 1 - Conservation of weight
Task 2 - Conservation of displacement volume
Task 3 - Separation of variables (using flexible metal rods)
Task 4 - Equilibrium in the balance

Students were scored separately on each task and responses categorised according to the following scale:

Piagetian Intellectual Level			Score
Level I	-	pre-operations	1
Level IIa	-	early concrete operations	2
Level IIb	-	complete concrete operations	3
Level IIIa	-	early formal operations	4
Level IIIb	-	complete formal operations	5

The maximum score for Task 1 was 3 and for Task 2 it was 4. As Tasks 3 and 4 measured to Level IIIb they each had a maximum score of 5. Hence, the maximum score on the battery was 17.

The total score on the battery was used to give an overall indication of a subject's level of intellectual development, *viz.*

Total Score	Predominant Level of Intellectual Development
16-17	IIIb
14-15	IIIa
11-13	IIb
8-10	IIa
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Results: Table 1 presents a summary of the results of longitudinal testing. It identifies the number of students at each year of school (grade level), the mean score on the task battery for each year and the number (and percentage) of students at each Piagetian level of intellectual development.

	YEAR OF SCHOOL					
	7	8	9	10	11	12
Number tested	106	112	49	93	25	45
Mean Score on Test Battery	11.9	12.9	13.3	13.9	14.4	15.5
Standard Deviation	2.0	2.0	1.8	1.6	1.2	1.3
No. and % at Level IIa	28 (26.4%)	15 (13.3%)	2 (4.1%)	2 (2.1%)	- -	- -
No. and % at Level IIb	52 (49.1%)	46 (41.2%)	24 (49%)	33 (35.5%)	7 (28%)	4 (8.9%)
No. and % at Level IIIa	22 (20.7%)	44 (38.9%)	18 (36.7%)	41 (44.1%)	13 (52%)	20 (44.4%)
No. and % at Level IIIb	3 (2.8%)	7 (6.2%)	5 (10.2%)	17 (18.3%)	5 (20%)	21 (46.7%)

TABLE 1: Summary Results of Longitudinal Testing.

The percentage of students at each Piagetian level for each year of school is depicted graphically in Figure 1.

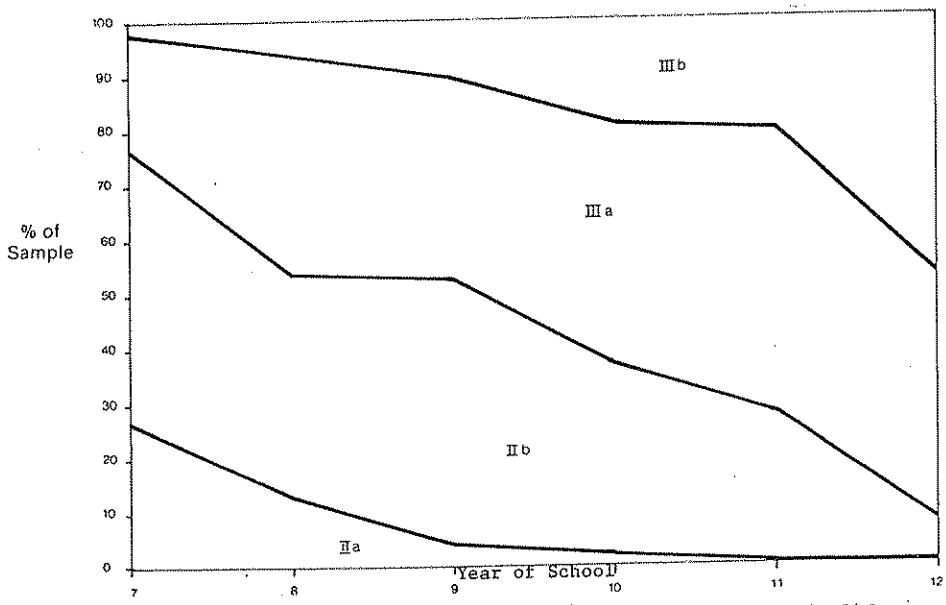

FIGURE 1.

Inspection of these results shows that intellectual growth did occur in the population studied over time. This global examination, however, gives no indication as to whether or not there is a differential drop-out from school and this matter is examined further below.

Figure 2 illustrates the proportion of students at each level of development for each school year.

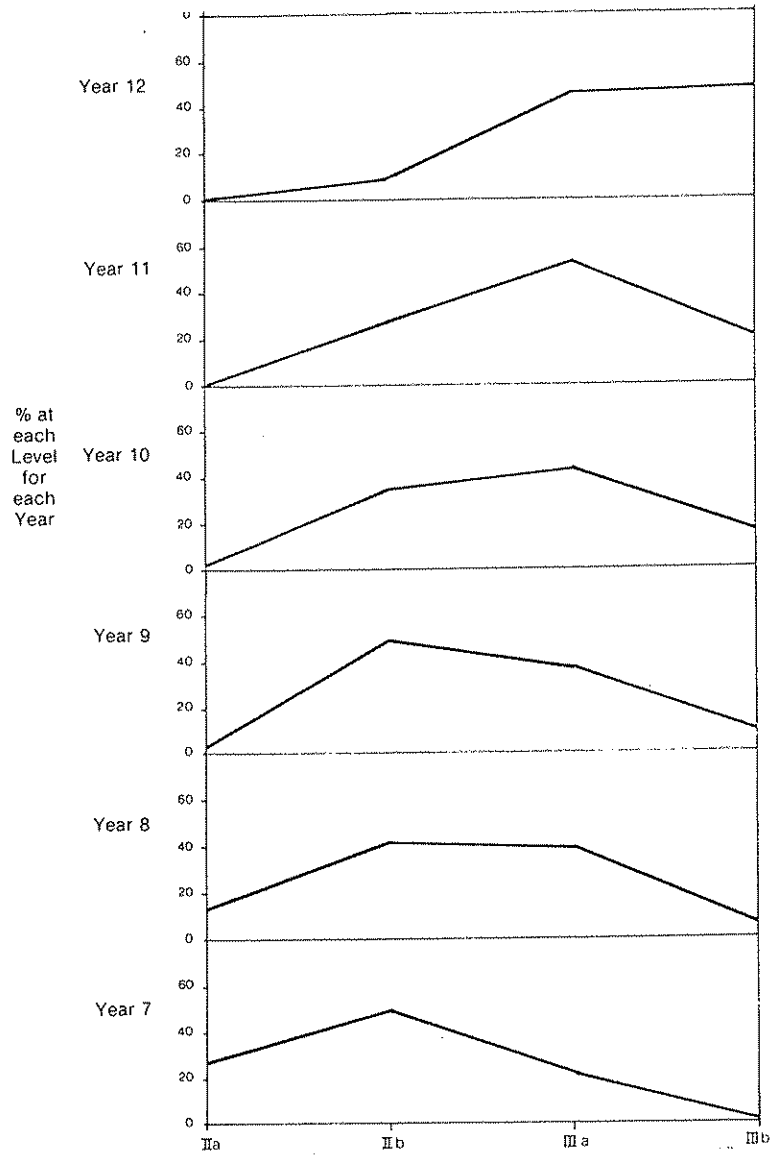

FIGURE 2.

Percentage of each Piagetian level of intellectual development for each school year.

/4

There was a marked decline in the proportion of early concrete-operational (level IIa) students between Years 7 and 9. After Year 9, there was a progressive increase in the proportion of students exhibiting formal-operational thought; initially due to a growth in the proportion at level IIIa, but after Year 11 there was an increase in the number at level IIIb.

If one assumes, as has Toepfer (1980), that Piaget's stages of intellectual development may reflect concomitant anatomical and neurophysiological developments, these results prove particularly interesting. Epstein (1974) has reported brain growth spurts associated with neural network formation between ages 2-4 years, 6-8 years, 10-12 years and 14-16+ years. It would seem, therefore, that most students are in a period of brain growth plateau for the first two to three years of secondary school. The onset of the brain growth spurt at age 14-16+ approximates the school Years 9-11; the time at which there is an increased development of formal operational reasoning. Likewise, it is conceivable that the transition noted from IIa to IIb between Year 7 and 9 was related to later completion of the 10-12 years brain growth spurt in slowly-maturing students.

Sex Differences in Performance on the Piagetian Tasks: An analysis of sex differences in performance on the battery of tasks at each year of school is presented in Table 2. At each year the mean score for males is higher than the mean score for females, but the differences in Years 9, 11 and 12 are not statistically significant.

	YEARS OF SCHOOL											
	7		8		9		10		11		12	
	M	F	M	F	M	F	M	F	M	F	M	F
Number Tested	56	50	57	54	26	23	50	43	16	11	22	23
Mean Score on Battery	12.6 (**)	11.1	13.6 (**)	12.1	13.5 (n.s.)	13.2	14.3 (**)	13.4	14.3 (n.s.)	14.1	15.7 (n.s.)	15.1
Standard Deviation	1.8	1.9	1.8	1.9	1.6	2.0	1.4	1.6	1.3	1.3	1.5	1.3

M = Male F = Female
** = significant difference between means at 0.01 level (1-tailed test)
n.s. = no significant difference between means at 0.05 level (")

TABLE 2: Performance on the Battery of Tasks at each Year of School According to Sex.

Superficially, it appears that the difference between the sexes was greater in the junior years of school and diminished in the senior years. Additional examination of the data described elsewhere (Blake, 1983) indicated that this was so.

Level of Intellectual Development and Retention at School: The initial testing of students in the sample categorised them into one of the Piagetian levels of intellectual development. One may ask whether level of intellectual development at time of entry into secondary school is influential in terms of retention at school.

Table 3 shows percentages of the total sample which left school at different stages of schooling, plus percentages for each sub-sample initially categorised at different levels of development. It also includes proportions of each sex.

The following key points emerge from these data:

(a) Approximately 29% of the sample left school before Year 10; of this group, slightly more than half were female.

(b) Of the 27% who completed Year 12, both sexes were equally represented.

(c) The cohort initially categorised as early concrete operational (level IIa) was predominantly female and they tended to leave school early: 42% before Year 10 and a further 36% at the end of Year 10. However, a few (15%) did complete six years of secondary school.

(d) The cohort initially categorised as complete concrete operational (level IIb) showed a more even distribution of the sexes. It would appear that females entering secondary school at level IIb tend to stay at school longer than their level IIa peers. Moreover, they stay to complete secondary schooling in greater numbers than their male counterparts.

(e) Students entering secondary school at level IIIa or above (i.e. showing evidence of formal operations) stay at school longer than their peers initially categorised /5

as concrete-operational.

	YEAR OF LEAVING SCHOOL							
	Before Year 10		End of Year 10		End of Year 11		End of Year 12	
Initial Sample (N=164)								
%leaving @ each stage	28.7%		35.4%		8.5%		27.4%	
- of these, % of each sex	44.7% M	55.3% F	56.9% M	43.1% F	64.3% M	35.7% F	51.1% M	48.9% F
Sample Initially @ Level IIa. (n=33)								
% leaving @ each stage	42.4%		36.4%		6.1%		15.1%	
- of these,% of each sex	28.6% M	71.4% F	33.3% M	66.7% F	50% M	50% F	20% M	80% F
Sample Initially @ Level IIb. (n=83)								
% leaving @ each stage	31.3%		36.1%		13.2%		19.4%	
- of these, % of each sex	50% M	50% F	63.3% M	36.7% F	72.7% M	27.3% F	31.2% M	68.8% F
Sample Initially @ Level IIIa.(n=43)								
% leaving @ each stage	16.3%		32.6%		0%		51.2%	
- of these, % of each sex	57.2% M	42.8% F	57.2% M	42.8% F	- M	- F	72.7% M	27.3% F
Sample Initially @ Level IIIb. (n=5)								
% leaving at each stage	0%		40%		20%		40%	
- of these, % of each sex	- M	- F	100% M	0% F	100% M	0% F	50% M	50% F

TABLE 3: Proportions of the Sample which Left School at Different Stages of Schooling.

It is useful, also, to examine retention data from the other perspective - the composition of groups or cohorts which left school at different stages of schooling. Table 4 presents an analysis of four cohorts according to Piagetian level of development at initial testing.

	INITIAL TESTING							
	Piagetian Level							
	IIa		IIb		IIIa		IIIb	
Initial Sample (N=164)								
% @ each level	20.1%		50.6%		26.2%		3%	
- of these, % of each sex	20.3% M	69.7% F	53% M	47% F	65.1% M	34.9% F	80% M	20% F
Cohort which left School before end Year 10 (n=47)								
% @ each level	29.8%		55.3%		14.9%		0%	
- of these, % of each sex	28.6% M	71.4% F	50% M	50% F	57.1% M	42.9% F	- M	- F
Cohort which left School at end Year 10 (n=58)								
% @ each level	20.7%		51.7%		24.1%		3.5%	
- of these, % of each sex	33.3% M	66.7% F	63.3% M	36.7% F	57.2% M	42.8% F	100% M	0% F
Cohort which left School at end Year 11 (n=14)								
% @ each level	7.1%		78.6%		0%		7.1%	
- of these, % of each sex	100% M	0% F	72.7% M	27.3% F	- M	- F	100% M	0% F
Cohort which left School at end Year 12 (n=45)								
% @ each level	11.1%		35.6%		48.9%		4.4%	
- of these, % of each sex	20% M	80% F	31.2% M	68.8% F	72.7% M	27.3% F	50% M	50% F

TABLE 4: Composition of the Cohorts which Left School at Different Stages Based upon Initial Categorisation into Levels of Intellectual Development.

/6

The following points emerge from these data:

(a) Almost 30% of the cohort which left school before Year 10 entered secondary school at level IIa (and of these 71% were female). A majority of the cohort left school still at the level of concrete operations.

(b) The cohort which left school at the end of Year 10 was quite different from that which left before Year 10. It contained twice as many students who exhibited some evidence of formal operations at initial testing and it showed evidence of intellectual growth during the years of schooling, with a clear majority leaving school showing some capacity for formal-operational thought.

(c) Although 53% of the cohort which left school at the end of Year 12 exhibited evidence of formal operations at initial testing, 11% initially were at level IIa (80% of whom were female).

It has been noted that females initially categorised at levels IIa and IIb account for a major proportion of the early drop-out from school. It is clear, however, that initial level of development is not the sole determiner of retention at school. Females initially categorised as concrete-operational do indeed complete secondary school, albeit in small numbers.

CONCLUSIONS AND IMPLICATIONS:

This study indicates that the nature of secondary schools favours those students who arrive at their doors relatively mature intellectually. Perhaps the most telling statistics are that 53% of the students who completed Year 12 were at level IIIa or IIIb at the time of initial testing and that 42% of the students initially categorised at level IIa left school before Year 10. In summary, it is possible to conclude:

(a) Measurable intellectual growth does occur during the secondary school years.

(b) Some students show more marked growth than others. In particular, the initial predominance of intellectual immaturity amongst females in the early years of secondary school diminishes over the years of schooling.

(c) Differential drop-out from school does occur and is related to level of intellectual development at the time of entry to secondary school. In particular, intellectually immature females tend to leave school quite early.

In light of the Arons and Karplus (1976) concerns, it is gratifying to note that adolescents do exhibit intellectual development during the secondary school years. This is small comfort, however, when one notes that a significant proportion of the population leaves school early at a relatively low level of intellectual maturity. What should become of these immature adolescents? Some members of the community, including some teachers, believe that they should not be kept at school. Stipek's analysis of the situation in the United States led her to the opposite view:

> Early school leaving may not be advisable for low-achieving students. Until adolescents have mastered basic skills and achieved a level of cognitive development that will allow them to function as responsible adults, they should not be employed in jobs which are unlikely to contribute to these skills. Such a policy does not solve the problem of the school's poor record in assisting these educationally-handicapped children. (Stipek, 1981, p. 135).

Her view is broadly in accord with the concepts underlying a "Full Education Policy" propounded by the Chairman of the Commonwealth Schools Commission (Tannock, 1983). This policy would "aim to guarantee that every Australian child will complete a full primary and secondary education at a satisfactory standard in such areas of interest, relevance and importance..."

This study demonstrates that the current situation falls short of Tannock's desires and Stipek's hopes. A first step towards the implementation of such a policy would be to retain the intellectually immature students at school for a longer time in order to foster maturity - intellectually, socially and emotionally. Clearly, this could only be achieved if these students were enthusiastic about their schooling. Many do not become so enthused, so changes are required.

Hobbs and Robinson (1982) have argued that it is possible to reverse cognitive deficits during adolescence. The work of Feuerstein *et al.*(1981) supports this contention. We, therefore, should be giving particular attention to constructing a curriculum which is overtly concerned with fostering the growth of intellect. In fact, this has been a major aim of many of the so-called enquiry-based curriculum developments of the sixties and seventies and there /7

is a body of theory which suggests that such a curriculum development is possible and appropriate (albeit complex and sophisticated).

Efforts to develop such a secondary curriculum would be more attuned to Tannock's Full Education Policy than many of the current transition education programmes. Studies of such programmes in the United States by Mangum and Walsh (1978), Stipek (1981) and Hobbs and Robinson (1982) indicate that transition education programmes in general do not assist with youth unemployment. Nor is there any evidence that such programmes improve basic educational skills and level of intellectual development.

Curriculum developments which encourage adolescents to remain at school, provide them with practical skills and facilitate intellectual maturity are likely to be a better long-term solution to youth unemployment. As such, they are likely to be a better national investment than transition courses which focus on specific employment orientated skills.

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