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ABSTRACT

A common concern raised by teachers from secondary schools and junior colleges in Singapore is the apparent inability or reluctance of adolescents to think critically and originally. Adolescent thought processes are probably shaped by the change in intellectual pace and quality between the primary and secondary school curriculum. This study of adolescent thinking considers the last two Piagetian states of cognitive development and the transition from concrete operations to formal operations, focussing on the adolescents' ability to make judgements and the extent to which adolescent judgement is guided by possibilities other than those given. A sample of 800 adolescents from 13 to 16 years of age was drawn from 6 schools. Subjects were asked to respond to the Test of Judgmental Ability, an anecdotal measure. The cross-sectional study revealed developmental differences in performances between adolescent males and females in favor of males, particularly at higher levels of judgement. Various analyses showed that age is the dominant factor accounting for differences in judgmental level, with academic achievement and home environment as contributing factors. Results suggest a transition period between the two forms of thinking. (WP)

ADOLESCENT THINKING: THE ABILITY TO IMAGINE POSSIBILITIES

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INTRODUCTION

In a recent meeting of General Paper teachers from pre-university centers and junior colleges in Singapore, a common concern that emerged was about the apparent inability or reluctance of "A" level students to think. This was stressed again among a meeting of junior college departmental heads of English, when they came to discuss a common viable approach to the General Paper. It was found that students seemingly prefer to regurgitate and to reproduce copiously from reference tomes than to commit themselves to original ideas. Some of the current dependence on model answers and examination notes may well reflect the same mental atrophy.

For the teacher who believes in helping every student towards his potential, this is frustrating. The teacher knows theoretically that the process of learning is related to thinking, yet he seems to achieve the former only at the expense of the latter. If the student is to "learn" his Geography or his Chemistry, it often appears that he copes only through rote-learning of a heap of facts. Learning by rote and thinking seem to pull in different directions. Yet this is surely not the real case. We know that by thinking, we learn more and at greater depth. The question is to connect the two processes so that they pull in tandem.

However this is far from common.

According to Abercrombie (1960), it was observed that "A" level students who were well grounded in scientific facts, did not always use scientific ways of thinking to solve problems. She noted that two or three years in the university did not improve these processes of thinking much either. Her observations would apply as much to the Singapore scene. Science graduates have been found not able to teach the "A" level General Paper because they have never studied it in the university (!) and English Arts graduates can only teach a text only if it had been on the university readings.

It is very clear that our students can pass examinations showing they have "learnt" (in a limited sense). It is not at all clear how our students are thinking while in that process of learning. Perhaps this is aggravated by the fact that teachers are not very sure how thinking is structured, and how they want their students to think. Most of them know what they want in the finished product; they value the original opinion, the imaginative essay, the assignment that can tie points together; but they are not quite sure how one student is able to do this and not another.

Hence a study of processes of thinking in adolescence may not be amiss. If it is possible to identify the various processes that initially lead an adolescent away from the child's specific mode of looking at things into a thinking based on hypothesising and the testing of hypotheses, it may increase our understanding

about the development of thinking from concrete thought to formal generalisation . An awareness of when these changes take place and the rate of these changes, and how they affect different age groups can help teachers to build that foundation of conceptualisation that will lead to active learning as opposed to a more passive mode.

The processes of thinking that an adolescent undergoes is probably underscored by the change in pace between the primary and the secondary school. What Peel (1965) quotes of the Newsom Report is applicable to Singapore: " the intellectual difference between primary and secondary school experience ... is more than a matter of attainment. There is a change of quality as well." (Peel, 1965, P 169).

In the secondary schools, the curriculum changes both in content and demand. Material is increasingly based on the student's ability to see possibilities rather than the restricted reality of actual situations. This can be seen in the introduction of History, Geography and Literature to secondary school students. In History, he is asked to learn, initially in a more descriptive sense, events of the past but the objectives of the syllabus make it quite clear that there are certain conclusions to be drawn and certain patterns to be observed. Similarly, in Geography, the young adolescent learns about land forms and how these influence occupational modes and patterns of living. Literature begins innocuously enough with an interesting story, only for students to derive from it, conclusions about characters

and about the consequences of certain behaviours. Constantly the emphasis is on relationships and the successful student is one who can go from "describer" thinking to "explainer" thinking (Peel, 1965). In other words, the student is expected to do more than just describe what he sees; he must attempt to put an explanation to it; he must postulate possible relationships.

This , of course, is very much linked to the ability to generalise. The ability to classify is practised already in the primary school and as the child progresses through the primary school years, he orders his experiences and sees greater meaning as he identifies and separates them into various classes, differentiated by some valid criterion. However, the primary school child, in the stage that Piaget calls "concrete operations" carries out this operation, as the name suggests, based on concrete experience, on what he actually experiences and he sorts these out by interacting them with his past experiences.

The adolescent on the other hand, classifies more than things in the secondary school. He classifies propositions. In addition, he can tolerate the possibility of there being other members in a classification that he may not yet be directly acquainted with. The ability to generalise in this manner demonstrates the greater flexibility of the adolescent. He has available " a large number of cognitive operations with which to attack problems" (Ginsberg & Opper, 1969, p 204). Among these cognitive operations is the manipulating and transforming of functions. The adolescent also isolates relevant variables and deduces relations between

these variables, something he is able to do because he begins in the realm of the hypothetical and imagines all the possible determinants of the result. These cognitive operations follow the rules of the logical model Piaget calls the INRC group, as well as a pattern he calls a "combinatorial system".

What differentiates the child of seven to eight years old and the child of eleven to twelve years is the ability of the latter to understand infinity, to tolerate not knowing the limits. This can be seen in many ways. The child who wants to know what is the biggest number in the world is also the one who wants to know who are the "good guys" and who are the "bad guys" in the story. If soldiers were "bad" in one movie, they cannot be "good" in another movie. He is a long way from the adolescent who can understand that any number divided by zero gives infinity, that a circle has an infinite number of sides, and that Richard the Lionheart could be both a gallant soldier and a less-than-effective king.

What brings the transition from one to the other is the growing tolerance for open-ended situations, a tolerance that comes as the adolescent subordinates "reality to possibility" (Inhelder & Piaget, 1958, p256) and even as reality becomes secondary to possibility, the adolescent turns from statements of the particular and the specific to statements couched in general terms, seeing the latter as a more significant mode of perception. Generalisation helps him to understand his world and his experiences more.

The attainment of this greater tolerance for open situations as opposed to closed situations is sometimes called maturity by teachers and it is rather obvious that the replacement of a fixed inflexible certainty with the ambiguity of various possibilities is a necessary part of an adolescent's thinking equipment. The teenager who cannot yet make the transition is stunted in his thinking; he cannot go very far if he restricts himself to unequivocal situations. To him, Macbeth remains a savage butcher, Lear a rather unfortunate father of undutiful daughters. But it is not only the complexities of life as presented by the humanities that are lost to him. So is the world of nuclear physics.

Much of the adolescent's thinking would seem therefore to be contingent on his ability to see possibilities and to tolerate ambiguity, for with this perspective, he begins to free himself from the concrete and he starts to hypothesise with second-order relations. (Lunzer, 1973). Alongside this faculty, the adolescent also begins to perceive relationships, often verbally, and to attribute greater significance to conceptual combinations that cover more possibilities.

In fact, a further characteristic of the secondary school is its greater use of and dependence on the verbal medium as a means of assessment. This is because language is an expression of perceived relationships, as can be seen both in the Arts and in the Sciences.

THE PRESENT STUDY

The present study of adolescent thinking in secondary schools in Singapore necessarily considered the involvement of the last two Piagetian stages and the transition from one stage to the other. The move from concrete operations to formal operations should be demonstrated by the emergence of operations hitherto not evident or evident only in a limited sense. An operation is "a means for mentally transforming data about the real world so that they can be organised and used selectively in the solution of problems. (Inhelder & Piaget, 1958).

In contrast to Piaget's INRC group and propositional logic models which he postulated as the structures present in formal operations, this study looks into Acceptance of Lack of Closure (ALC) as formulated by Lunzer(1973). ALC was seen in the light of an alternative structure that appears in the thinking of adolescents. However ALC was measured as it was expressed in a verbal medium (as in Peel, 1966) and not as demonstrated in mathematical operations (as in Collis, 1972) or in scientific experiments (as in Inhelder & Piaget, 1958).

In this study, the adolescent who took the given content as decisive, who failed or would not reconcile opposing conclusions and who did not conceive of unstated possibilities was performing a kind of "premature closure". In so doing, he was still controlled by concrete thinking. Halford (1970) points out that in acquiring concrete operations, children will need to combine judgments and reorganise them to give unique results, thus

achieving closure. In other words, the child at the stage of concrete reasoning depends on immediate closure for a situation to be meaningful. (Collis, 1978).

The adolescent, however, who takes account of all evidence and measures the inadequacy of such evidence and supplements it or acknowledges its lack from his store of general knowledge, has shown greater tolerance for unclosed operations. He can withhold closing while he considers the effects of different variables in the problem.

SAMPLE and METHODOLOGY

The study drew its sample from six secondary schools. As Singapore schools are fairly rigidly divided, sampling was necessarily stratified to include :

*government schools and mission schools

*single-sex schools and mixed schools

*small, medium and large schools in terms of student population

*schools with low entry points and schools with high entry points into secondary one.

Students from Secondary One to Secondary Four classes in the express-stream of these schools were randomly selected. (Table 1). The sample ultimately consisted of 200 subjects for each age group.

These students were asked to respond to the Test of Judgmental Ability (TOJA). This was made up of ten anecdotes, seven of which

Peel had experimented with in the UK and three other anecdotes independently constructed out of "logically similar material" from Peel's own criterion. Each anecdote was followed by an open question about some feature of the passage that required the respondent to give reasons for his answer.

The anecdotes came in the form of a passage containing a leading statement which was irrelevant to the judgment required in answering the question. This was followed by a short section in which a happening took place. This happening was related to the question but was not by itself sufficient to form the basis of a judgment. A limitation was also imposed by other circumstances which might be stated or implied.

Subjects responded by choosing one of three alternative answers to the question which ended each episode. The alternatives allowed the subject to agree with the question, to disagree or to say he was unable to decide. In addition, subjects had to complete the alternative chosen by giving their reasons.

In the scoring, more attention was given to the reason rather than the choice of alternative. The three alternatives were so worded as to make the subjects aware that any of the three choices were acceptable. However it was the reasons given that contained the real value of the answer.

The answers were categorised as follows:

Level 1 where the answer was irrelevant or merely tautological

Level 2a where the answer was decided solely by the obvious circumstance in the anecdote.

Level 2b where the answer was decided by the obvious circumstance but also supported by other circumstances and often the subject's own awareness.

Level 3 where the answer showed an awareness of other possibilities not mentioned in the anecdote.

As the categories were in an ascending order of judgmental ability, Levels 1, 2a, 2b and 3 were given a weightage of 1,2,3 and 4 respectively, and the total score was the sum of the item-scores so awarded.

ANALYSIS

It can be seen that there is an increase in the mean scores with age.(Table 2). An analysis of the variance (ANOVA) in the different age groups revealed that the variance was significant at 0.05 level. A pairwise comparison showed that there was not only significant difference between the mean scores at age 13 and age 16, but also significant difference between age 13 and age 14, as well as between age 15 and age 16. In other words, the mean total scores for the Test of Judgmental Ability showed that secondary school students had increasingly higher TOJA scores with age. The secondary school students were increasingly able to invoke possibilities beyond the given context as they grew older. The change seemed to take place more clearly in the transition from age 13 to age 14, and from age 15 to age 16.

In a breakdown of the mean at different ages for each of the subscores, it was noticed that while Levels 1 and 2a showed a decrease in the mean score with age, Levels 2b and 3 showed an increase in the mean score. Younger students showed a greater tendency towards tautological answers and answers limited to one circumstance, while older students showed an ability to look at more than one circumstance and to invoke possibilities beyond those given in the situation.

The difference in the mean scores for each group was significant for every level of answers, when an ANOVA was performed. A pairwise comparison showed that the difference in mean scores between age group 13 and age group 16 was always significant as well. (Table 3).

The hypothesis that there would be differences between boys and girls in the quality of thinking was tested. It is possible that they would differ in their pattern of change from circumstantial (Level 1 and 2) to imaginative-type explanation (Level 3). The scores of both boys and girls were analysed separately. When total scores were considered (Table 4) it could be seen that male scores increased with age. An ANOVA further showed that the increase was significant not only between the youngest and oldest age groups, but also between consecutive pairs of age groups. When different levels of judgment were considered separately, it appeared that the higher the judgmental level, the later is the age range at which male students change significantly in their mean scores.

The performance of female subjects likewise showed an increase in mean total scores with age. However an ANOVA (Table 5) showed that the difference was significant only between ages 13 and 14 and not between other consecutive pairs of age groups. When considering the female response to different levels, it could be said that they seemed to follow the overall trend except in Level 3. It appeared that unlike the other judgmental levels, Level 3 responses invoking possibilities outside the given context did not significantly increase in females between 13 and 16.

There would appear therefore to be some differences between male and female performance in judgmental ability. From the tables and graphs , the significant differences would seem to occur when it came to higher levels of judgment. When offering explanations to judgments that were limited to the given circumstances (Level 2b), females seemed to show a steady and substantial increase from age group to age group. On the other hand, males increased in their mean scores fairly substantially in the earlier age groups but the increase is less perceptible between ages 15 and 16, so much so that the mean scores for the females which were hitherto lower than those of the males in this judgmental level, ultimately reached a higher score than the males did at age 16.

The females showed a steady and substantial increase in their ability to reason within a given set of circumstances but the development in their ability to invoke outside circumstances was rather more erratic. Thus after a sharp increase in mean scores between age groups 13 and 14, the scores peter off so that at age

16, the females' mean score is overtaken by that of the males who have maintained a steady and substantial increase in mean scores from ages 13 to 16.

While there was little difference between males and females in that they both showed roughly similar declining scores in the lower judgmental levels, there is a marked difference in their performance in the more sophisticated levels of judgment. The girls steadily develop in their ability to offer explanations within given circumstances and the boys however develop substantially and positively in their ability to invoke circumstances beyond the context.

The present study also investigated the possible relationships between judgmental levels and the following variables: academic achievement, reading ability, father's educational level and mother's educational level. A stepwise regression was performed to see how much the above variables contributed to the variance in the judgmental level scores. Age, verbal ability, academic achievement, gender and parents' education were found to have contributed to 23% of the variance. (Table 6). Of these variables, age accounted for the greatest amount of the variance. This result was not unexpected , as age had been identified as the independent variable affecting the ability to see beyond the given context. The older the subject, the more he was likely to imagine possibilities and the less he was restricted to the situation as given.

What has come across most strongly in the analysis of data is the declining tendency to be limited to a single given circumstance when comparing adolescents at age 16 with those at age 13. Complementing this is an increasing ability to invoke outside possibilities. The judgmental ability of adolescents increases between ages 13 and 16 as they are able to gradually balance the various circumstances, dealing with possible combinations of the circumstances. In so doing, they have shown a growing tolerance for open situations, a growing ability to deal with lack of closure.

Less sharply, but nevertheless perceptibly, there has emerged in adolescents, a growing preference for more abstract statements as holding more potential and meaning when opposed to statements of incidental association and concrete groupings. This could imply a tendency to regard concrete statements as limited, and a greater dependency on generalising as a meaningful way of interpreting situations and selecting strategies for solution.

DISCUSSION

The various analyses have shown that age is the dominant factor accounting for differences in judgmental level as shown by the TOJA scores. In most of the sub-scores, the most dramatic change took place between 13 and 14. Sex differences and home environment did not attribute much though academic achievement correlate much higher with judgmental ability than the other two factors.

It is possible to conclude that an ability to invoke possibilities beyond what is given increases with age. Circumstantial judgments, the largest number of which came from 13 year olds, latched onto a circumstance in the situation that answered the question to the exclusion of other factors. The circumstance was usually presented in concrete terms eg:

"Jill was not kind to her sister because she wanted to throw her sister down the cliff."

"The pilot was not careful because he crashed into the cable cars."

"David was not hardworking because he failed his Maths test."

In Lunzer's terms, the children's inclination towards neatness and definite-ness of solution shows premature closure in a very clear way.

More in the older age groups were able to give responses that attempted to balance the various factors contained in the situation. Responses of this nature still ultimately made an absolute judgment but tried to relate the other variables logically at the same time eg:

"Jill was kind to her sister, even though she got angry with her. This was shown by her saving up money to bring her sister along on the holiday."

"The pilot was not careful because he should have known that there were cable cars in the area."

"David was hardworking but perhaps he failed because he forgot to study in his excitement over the holiday trip."

The definiteness of judgment is still there but the subject feels the necessity of logically disposing of the other factors. This shows there is still a tendency to premature closure.

The highest level of judgment in this study shows an ability to take each variable separately, weigh each against the rest, and bring in variables from their own experience eg:

> "I don't know whether Jill was unkind. People do say things in anger and not really mean it. Anyone would have got angry if his hard-earned money was lost."
>
> "I don't know if the pilot had been careless. Perhaps he had fallen ill at that moment, or had lost control of his airplane."
>
> "I can't tell if David was hardworking. Some people just can't do Maths even if they work hard."

These responses show an ability to delay judgment. A favourite phrase used was "It depends". Subjects could withhold and tolerate lack of closure.

The fact that age contributes so much more to the difference in scores in the sample than the variables of sex, academic achievement and home environment, would tend to confirm that judgmental ability is not a development contingent on individual differences. Rather, subjects seem to develop their judgmental ability with maturity, relatively independent of these differences. This lends weight to Collis' assertion that an Acceptance of Lack of Closure (ALC) has an enabling role to play in the development of thinking or formal operations. It also

bears out Lunzer's proposition that the same Acceptance of Lack of Closure is a general structure that can be detected in formal thinking.

It is interesting to note that older subjects show more of the responses that accepted lack of closure and that the scores for the highest judgmental level increase significantly with age, even in the oldest age group. The largest number of responses however were circumstantial judgments albeit accompanied with explanations that attempted to balance the various circumstances logically. It will appear therefore that even at age 16, adolescents are not entirely comfortable about delaying judgment, about considering variables outside the given context.

This is not entirely disassociated with the trend in the preference for generality that the same subjects have demonstrated. As with Peel's (1975) original study, the preference for generalisation among all age groups is the highest. But the next strongest preference which is for concrete statements of membership in the younger age groups, is overtaken by a preference for abstract statements in the older age groups. Yet even so, the preference for abstract statements never overtakes the preference for generalisation. The preference for generalisation among adolescents in secondary school is quite firmly established even in the lower age groups.

IMPLICATIONS

There are several implications to be considered. What the results have shown is that adolescents demonstrate a greater predilection for abstract terms as well as a greater tolerance for lack of closure with age. However, even in the oldest age group in this study, this predilection and tolerance are not totally dominant.

What the results have not shown is a clean break from one kind of thinking into another and what the findings seem to imply is transition. Subjects are able to invoke ideas and to explain phenomena but in other contexts, the same subjects go back to closed situations and limit themselves to the circumstances given. Subjects choose the abstract level of statement for some topics, yet in others go back to the concrete-general and even the concrete-membership type of statement.

The TOJA protocols also indicate that it is possible to find some of the answers which, while ostensibly in the circumstantial judgment category, gave reasoned accounts that considered all the variables but they ultimately arrived at a judgment that demands closure.

This implies that the INRC grouping and the 16 binary propositions are not only not universal, a tolerance for lack of closure and a preference for more complex systems are not universal either. On the other hand, it could be that adolescents do not always operate at their optimum level all the time. A possible reason is that adolescents, when exhibiting circumstantial judgment and explaining phenomena within the given

circumstances, are showing a selective use of formal reasoning. They may have tested the outside possibilities and still find the given possibilities more valid.

What has emerged in this study therefore is not an unequivocal description of the reasoning processes that demonstrate the existence of formal reasoning structures. Rather, what comes across most strongly are the various explanations that can be offered to interpret thinking in adolescents. It is realised that formal operations is very complex and that if a certain mode of thinking is not adopted, it is not necessarily through inability, but more possibly through conscious choice.

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Table 1

Composition of Age Groups in Sample

Age Group	Male	Female	Total
13	100	100	200
14	100	100	200
15	100	100	200
16	100	100	200
Total	400	400	800

Table 2

Mean Scores and Standard Deviations of Age Groups for Judgmental Levels inthe Test of Judgmental Ability (TOJA)

Age Group	N	Judgmental Levels				Total Score
		Level 1	Level 2a	Level 2b	Level 3	
13	200	0.50(0.86)	3.09(2.07)	3.29(1.98)	3.14(1.93)	29.10(4.18)
14	200	0.25(0.57)	2.21(1.70)	3.61(1.85)	3.93(2.05)	31.34(3.75)
15	200	0.11(0.39)	1.62(1.60)	4.45(1.65)	3.82(1.90)	31.97(3.41)
16	200	0.06(0.26)	0.62(1.08)	5.09(1.68)	4.24(1.78)	33.46(2.58)

Table 3

ANOVA in Age Groups for Judgmental Levels in the Test of Judgmental Ability (TOJA)

Dependent Variable	Source	df	Sum of Squares	Mean Square	F value	pr > F	Pairwise comparisons			
							13 - 14	14 - 15	15 - 16	13 - 16
Level 1	Between Error Total	3 796 799	23.28 253.86 277.14	7.76 0.32	24.34	0.0001	*			*
Level 2a	Between Error Total	3 796 799	642.57 2168.39 2810.96	214.19 2.72	78.63	0.0001	*	*	*	*
Level 2b	Between Error Total	3 796 799	399.37 2561.39 2960.76	133.12 3.22	41.37	0.0001		*	*	*
Level 3	Between Error Total	3 796 799	127.85 2925.43 3053.28	42.62 3.68	11.60	0.0001	*			*

* Significant difference between age groups at 0.05 level

Table 4

Mean Scores and Standard Deviations of Male and Female Age Groups for Judgmental Levels in the Test of Judgmental Ability

Age Group	N	Judgmental Levels				Total Score
		Level 1	Level 2a	Level 2b	Level 3	
Males						
13	100	0.63(0.97)	3.01(2.18)	3.52(2.12)	2.85(1.92)	28.55(4.40)
14	100	0.28(0.60)	2.27(1.80)	4.00(1.84)	3.43(1.94)	30.70(3.71)
15	100	0.11(0.37)	1.34(1.36)	4.81(1.51)	3.73(1.87)	32.18(3.23)
16	100	0.04(0.24)	0.51(1.10)	4.99(1.73)	4.46(1.79)	33.81(2.50)
Females						
13	100	0.37(0.71)	3.16(1.96)	3.05(1.80)	3.43(1.90)	29.64(3.90)
14	100	0.21(0.54)	2.14(1.59)	3.22(1.78)	4.42(2.04)	31.99(3.71)
15	100	0.11(0.40)	1.90(1.77)	4.09(1.72)	3.91(1.93)	31.76(3.58)
16	100	0.08(0.27)	0.73(1.05)	5.18(1.64)	4.01(1.76)	33.10(2.62)

Table 5

Dependent Variable	Source	df	Sum of Squares	Mean Square	F value	pr > F	Pairwise comparisons			
							13 - 14	14 - 15	15 - 16	13 - 16
Males Level 1	Between Error Total	3 396 399	20.81 149.10 169.91	6.94 0.38	18.42	0.0001	*			*
Level 2a	Between Error Total	3 396 399	355.95 1096.13 1452.08	118.65 2.77	42.86	0.0001	*	*	*	*
Level 2b	Between Error Total	3 396 399	143.10 1301.34 1444.44	47.70 3.29	14.52	0.0001		*		*
Level 3	Between Error Total	3 396 399	134.67 1401.81 1536.48	44.89 3.54	12.68	0.0001			*	*
Total Score	Between Error Total	3 396 399	1499.66 4929.90 6429.56	499.89 12.45	40.15	0.0001	*	*	*	*
Females Level 1	Between Error Total	3 396 399	5.13 101.05 106.18	1.71 0.26	6.70	0.0003				*
Level 2a	Between Error Total	3 396 399	298.69 1052.19 1350.88	99.56 2.66	37.47	0.0001	*		*	*
Level 2b	Between Error Total	3 396 399	285.85 1190.86 1476.71	95.28 3.01	31.68	0.0001		*	*	*
Level 3	Between Error Total	3 396 399	49.63 1446.05 1495.68	16.54 3.65	4.53	0.0041	*			
Total Score	Between Error Total	3 396 399	626.73 4813.27 5440.00	208.91 12.15	17.19	0.0001	*		*	*

ANOVA in Male and Female Age Groups for Judgmental Levels and Total Scores

* significant difference between age groups at 0.05 level

Table 6

Stepwise Regression of Independent and Intervening Variables on the Ability to Imagine Possiblities

Variable entered	R square	RSQ change	F-value*
Age	0.1580		149.72
Verbal Ability	0.2041	0.0461	102.18
Academic Achievement	0.2235	0.0194	76.39
Father's Education	0.2296	0.0061	59.23
Gender	0.2307	0.0011	47.63
Mother's Education	0.2313	0.0006	39.78

* All F-values are significant at 0.05 level

ABSTRACT

Adolescent Thinking : The Ability to Imagine Possibilities

A common concern raised by teachers from secondary schools and junior colleges in Singapore is the apparent inability or reluctance of our adolescents to think. It was found that students seemingly prefer to regurgitate and to reproduce copiously from reference tomes than to commit themselves to original ideas. For the school who believes in helping every student towards his potential, this is frustrating. Teachers know theoretically that the process of learning is related to thinking, yet they seem to achieve the former only at the expense of the latter.

The process of thinking that an adolescent undergoes is probably underscored by the change in intellectual pace and quality between the primary and secondary school curriculum.
This study of adolescent thinking in Singapore considers the last two Piagetian stages of cognitive development and the transition from concrete operations to formal operations. It focusses on the adolescent's ability to judge and the extent to which their judgement is guided by possibilities other than those given. Use is made of two instruments initially developed by Peel for estimating the tolerance adolescents have towards lack of closure in verbal situations and their degree of preference for abstract as opposed to concrete terms.

The sample is based on 800 adolescents whose ages ranged from 13 to 16. The cross sectional study revealed developmental differences in performances between adolescent males and females. Home background and academic abilities are also important variables considered. The study of the intellectual evolution of adolescents is very complex as indicated in this paper.. Some problems and implications for teaching and learning in the schools are discussed.

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