The Mathematics Problem-Solving Ability Of Form Four Secondary School Students – The Case Of Sri Aman

by

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ABSTRACT

This paper reports the findings of a research project studying the problem-solving ability of Form Four secondary school students in Sri Aman Division. This project aimed to identify the problem-solving ability, the problem-solving skills and the thinking processes of form four students while solving mathematics problems. Several findings emerged. The overall performance of students declines drastically as the level of difficulty of problems increases. However, students with good PMR results are able to maintain their performance as the level of difficulty increases. There is a statistically significant gender-related difference in mathematics ability in favor of female students. Racial-ethnic differences in mathematics achievement are very pervasive; large differences remain between the mathematics achievements of Chinese students, Malay students and Iban students. There is also a consistent disparity in mathematics achievement that is related to the socioeconomic status of these students. These students do employ the four phases of problem solving and regulate their thinking process in the process of solving mathematics problems.

INTRODUCTION

Since the 1990s, there have been great changes in the emphases being placed on the mathematics curriculum. New curriculum documents have been compiled that promote these emphases such as problem solving and metacognition. Educators have been engaged in research on mathematics problems, problem solving and metacognition. The findings are disseminated to schools that aid the effective teaching of mathematics. It is hoped that students will be engaged in more meaningful learning and acquire good problem-solving techniques.

MATHEMATICS PROBLEMS

The nature of problems plays a very important role in mathematics education. A mathematics teacher knows that mathematics and problems are heavily interwoven. But can he give a convincing answer to questions like ‘What is a problem?’ or ‘Are the questions at the back of each section in a textbook problems?’. Kilpatrick (1982) poses the following question, which reflects the importance of problems in mathematics education.

> *'How can the teacher who has never reflected on what a problem is make problem solving the centerpiece of the school mathematics curriculum?' (p. 1)*

Among others, Charles and Lester (1982) define a problem as a task for which a problem solver confronting it wants or needs to find a solution, this person has no readily available procedure for finding the solution, but he or she must make an attempt to find the solution. In other words, first, a problem-solver needs to comprehend the problem in hand and becomes aware of it. Second, the problem-solver needs to make proposals bridging the gap between the given and the desired end of a problem, which constitutes the solution. Finally, the process will only be successful if the problem-solver accepts the challenge to find the solution.

Teachers can be further assisted to assess the educational value of a problem by a classification of problems. No matter how we classify problems, they can fall into the four levels of difficulty proposed by Pólya (1981).

1. One rule under your nose: Those problems that can be solved by using the rule, or procedure that has just been discussed.
2. Application: Those problems that can be solved by using a rule or procedure selected by some good judgment from those previously studied.
3. Choice of a combination: Those problems that can be solved by using two or more rules, procedures or algorithms, previously studied, in the correct combination.
4. Approaching research level: Those problems that need the orchestration of rules or procedures and heuristics reasoning, formulation and reformulation of conjectures and searching for more information to nullify or accept the conjectures.

In a classroom situation, students are always given problems of type (1) and (2) of Pólya's classifications. These problems, like those at the back of each topic in traditional textbooks, should be termed 'exercises', which function only to give students exercise in certain skills, after they have learnt these skills. They give students no training in calling to mind possible solutions and discriminating between them. But if they are given these problems before they are taught these skills, then the above problems will be real problems for them. They might be able to come up with different acceptable solutions using different strategies.

Far too few problems given to students are from type (3) and (4) of Pólya's classification. These types of problems demand higher cognitive processes. The problems will undergo successive transformations (Duncker, 1945) or a series of formulations and reformulations (Lakatos, 1976). By doing so, students have a chance to experience how experts solve mathematics problems.

PROBLEM SOLVING

Literally, problem solving in mathematics is the attempt to find the solution to a problem when the method is not known to a problem-solver. Then the problem-solver has to use strategic skills to select the appropriate techniques for a solution. Among others, Pólya (1973) puts forward a four-phase model of problem solving:

First	Understanding the problem – This includes reading and clarifying a problem to identify the known, the unknown and the goal.
Second	Devising a plan – This stage is the choosing of a strategy and devising a plan for a solution to the problem.
Third	Carrying out the plan – Once a problem solver has a plan, the problem solver will execute this plan and write out a solution.
Fourth	Looking back – When a solution is ready, the problem solver needs to check the legitimacy of this solution for the problem.

Every problem-solver will notice that when tackling a problem, it is not just a simple top-down process of the above four stages.

> *'In practice all the phases get mixed up and are carried out in parallel, each new discovery tends to modify the overall plan.' (Pólya, 1973, p. xix)*

The problem is often not completely understood until the problem-solver has tried and failed to arrive at a solution using different strategies. It is a series of going forward and backward among the four stages. For instance, when checking the solution, a problem-solver may still find an error due to overlooking an aspect of the problem. Then the problem-solver will go back to further clarify the problem and modify the plan or devise a new plan.

Fernandez, Hadaway and Wilson (1994) provide a problem-solving model (see Figure 1), which includes the managerial processes or what other educators such as Schoenfeld, Flavell and Brown call metacognition. This figure shows the non-linearity of problem solving which is actually experienced by problem-solvers. The clockwise and anti-clockwise nature of the cycle suggests that the problem-solving process can go top-down or bottom-up with reference to Pólya's model. The managerial processes or metacognitive skills will trigger the problem-solver to jump a stage or stages.

METACOGNITION

The concept of metacognition was first defined in the seventies. Many mathematics educators have shown great interest in this area as they realize that purely cognitive analyses of mathematical performance are inadequate for studying problem solving. Flavell (1976) says that metacognition refers to 'the active monitoring and consequent regulation and orchestration of [cognitive] processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective' (p. 232).

Despite the apparent importance of metacognition in mathematical performance, there is very little research being done on metacognition. However, Schoenfeld (1985) develops a framework for parsing problem solving sessions into episodes and executive decisions aiming at analyzing problem-solving moves. These episodes include reading, analyzing, exploring, planning, implementing and verifying. It is at the junctures between episodes, in most cases, where metacognitive decisions such as decisions as to what to pursue, or what to abandon, can have a powerful impact on solution attempts. On one hand, this analysis of problem solving sessions provides a way of identifying and focusing on those key decisions that may in themselves determine success or failure during problem-solving sessions. On the other hand, it also provides a way to study the consequences of the absence of metacognitive decisions.

RESEARCH PROJECT

Even though educators report much progress on students' performance in mathematics, mathematics still seems to be one of the difficult subjects for school students. For instance, Von Glaserfeld (1995) says that

> *'[Educators] have noticed that many students were quite able to learn the necessary formulas and apply them to the limited range of textbook and test situations, but when faced with novel problems, they fell short and showed that they were far from having understood the relevant concepts and conceptual relations.' (p. 20)*

When the results of the Malaysian Certificate of Education examination for the year 2001 were released, the Director General of Malaysian Ministry of Education commented that the results of mathematics papers had declined for the past three years. He attributed this decline to the lack of mastery of basic mathematics skills and creative, critical and higher order thinking of our students (New Straits Times, 28.2.2002, Sin Chiew Jit Poh, 28.2.2002).

A research project named 'The Thinking Processes of Mathematics Problem Solving of Form Four Secondary School Students' was carried out in Sri Aman Division. The objectives are to identify the problem-solving ability and the thinking processes of Form Four students solving mathematics problems of the four levels of difficulty proposed by Polya (1981). Stratified sampling method was used to select 412 form four students from a total of 2962 students from the 16 secondary schools in Sri Aman Division offering form four class.

Four sets of problems, one set for each level of difficulty were designed and administered to the sample of students aiming to assess their ability in answering the problems for each level of difficulty. On top of these, three sets of questionnaire were designed for students to answer aiming to gather further information on their personal background and the mathematics skills and problem-solving skills employed while answering the problems of the various levels of difficulty.

The researchers also designed another set of questions equivalent to the third or fourth level of difficulty of mathematics problems. These questions were posed to 18 selected students aiming to identify their thinking processes while solving these problems. The answering session for each student was video-recorded separately. The answer script and any rough work were collected back. After each video recording session, the researchers met, watched the tape and discussed on issues that needed clarification from the student relating to problem-solving skills and problem-solving processes employed while solving the questions. At a latter time, the tape was replayed to the student. At the same time, the researchers conducted an interview with this student to gather more information on these identified issues. These interviews were taped and these audiotapes were transcribed.

The analysis of data collected to identify the problem-solving ability was predominately quantitative and done by using SPSS version 10.0. Frequency distribution and mean were used to identify the ability of participating students answering the four levels of difficulty of mathematics problems. On top of these, a regression analysis was also performed to identify the adequacy of the variables of this study to determine success in problem solving of students. The analysis of data collected to identify the thinking processes was predominately qualitative. Scheonfeld's (1985) episode-parsing framework was adopted. These analyses were used to plot time-line graphs of the time spent on each phase against that phase for a whole answering session by students to identify the presence of metacognitive skills or executive skills.

FINDINGS AND DISCUSSION

There is a decline in achievement of the participating students while solving mathematics problems of different levels of difficulty when the level of difficulty increases. The percentage of students able to solve (with moderate and high achievement) decreases drastically from 75.7 % for level (1) problems to 6.1 % for level (4) problems (see Table 1). This phenomenon occurs because most of the problems given to students in schools are problems from level (1) difficulty. These problems, like those at the back of each topic in traditional textbooks, should be termed as 'exercises', which function only to give students practice in certain skills, after they have learnt these skills (Pólya, 1973). They give students no training in calling to mind possible solutions and discriminating between them. The students cannot perform for problems of the third and fourth levels of difficulty because these problems not only demand the mastery of basic mathematics skills but also require higher cognitive processes such as transformations or a series of formulation and reformulations to solve them (Duncker, 1945, Lakatos, 1976).

The majority of the students do well in problems at the first level of difficulty. However, only students with good PMR results are able to maintain their performance as the level of difficulty increases. The percentages of students with an A in PMR mathematics, able to achieve above the moderate level in each level of difficulty, are 93.0 per cent, 93.0 per cent, 51.2 per cent and 32.6 per cent respectively (see Table 2). The mean scores are 11.50, 10.23, 7.33 and 3.86 respectively (see Table 3).

The overall performance of the female students in solving mathematics problems is better than the male students for the first three levels of difficulty. The total percentages of female and male students in moderate and high achievement are: 76.5 % against 74.2 % for level (1); 50.0 % against 41.5 % for level (2); 22.2 % against 20.8 % for level (3) and 6 % against 6.3 % for level (4) respectively (see Table 4). However, the mean scores for female students are higher than the male students for all the four levels (see table 4). The nature of gender-related differences in mathematics ability is a topic being actively researched within the education community. The above finding is consistent with the conclusion by Zambo and Follman (1994) that there is a statistically significant gender-related difference in mathematics ability in favor of female, based on the higher overall mean score.

The ability of the Chinese students in solving mathematics problems for all levels of difficulty is the highest as compared to the other ethnic groups, with the mean scores of 9.32, 7.89, 4.40 and 2.27 for the four levels respectively. This is followed by the Malay students (mean scores of 9.14, 5.66, 3.40 and 1.17 for the four levels respectively) and "Others" students (mean scores of 8.71, 6.29, 3.18 and 1.00 for the four levels respectively). The ability of Iban students solving the various levels of problems is the lowest among the ethnic groups with the mean scores of 8.14, 4.43, 2.74 and 0.88 respectively (see Table 6 and table 7). There are many studies on racial-ethnic differences in mathematics achievement done overseas. The finding of this study is in line with the conclusion of studies in the United States that racial-ethnic differences in mathematics achievement are very pervasive; large differences remain between the mathematics achievements of different ethnic groups (Lockheed & Colleagues, 1985, Tate, 1997).

Students who are from family income between RM1000 – RM1500 score the highest mean score as compared to other income groups in level (1), (2) and (3) of difficulty. Their mean scores are 10.69, 8.28, 5.38 and 2.81 respectively. This is followed by family income group of more than RM2000 (mean scores of 10.47, 7.65, 3.94 and 3.59 respectively (see Table 9). By grouping students into family income of less than RM1000 and more than RM1000, it is found that students from family income of more than RM1000 perform better. The percentages of students who achieve above moderate for family income of less than RM1000 are 75.3 per cent, 42.5 per cent, 19.1 per cent and 4.1 per cent respectively and 86.2 per cent, 72.4 per cent 27.6 per cent and 17.4 per cent respectively for students who achieve above moderate for family income of more than RM1000 (see Table 8). This finding is consistent with the conclusion that there is a consistent disparity in mathematics achievement that is related to socioeconomic status of students made by Secada (1992), Rasinski et al. (1993), Tate (1997) and NCTM (2001).

All the variables under this study for students' achievement can be divided into three categories. These are problem-solving skill, basic mathematics skill and students' characteristics. A regression analysis is conducted on the problem-solving ability of these students and the variables of this study. R^2 is 0.536. This means that the variables for this study only account for 53.6 per cent of all the factors that influence the students' achievement in mathematics problem solving. The normal probability plot and the residual plot show that the residuals are not randomly distributed (see Figure 2 and Figure 3). In other words, there are other variables that need to be considered.

Two cases are presented to facilitate discussion on the thinking process of mathematics problem solving of the target students.

Case I – Simon is one of the students having ability hardly meet the first level of difficulty of mathematics problems. Figure 4 in the Appendix represents the time-line graph of Simon working on a problem. Simon went top-down for the four stages of problem solving, showing no sign of metacognitive skills being employed. He chose a wrong strategy and executed it for a solution. After checking the solution by *'… reading the problem once again'*, he was satisfied with his solution. However, he admitted that he was not sure whether his solution was right or wrong. When asked about solving the problem using algebra, he *'…forgot …, did not know …'* the method.

Case II – Angela is tipped to be one of the best students in mathematics from school A. Figure 5 in the Appendix represents the time-line graph of Angela working on the same problem given to Simon. Angela had gone through all the four phases of problem solving. After reading and understanding the problem, she started planning for a solution. The three small inverted triangles on the first part of the planning stage indicate that she changed her strategy for a solution three times, before taking up trial and error. When she was asked to comment on these changes in strategies, she said: *'Because I felt my method is wrong … I thought of a better method.'* After she took up trial and error, she carried out her plan for a solution and checked her answer to find out that it was wrong. She commented: *'… the method was inefficient and slow.'* Angela switched back to planning stage, where she *'… made the ratio smaller … for easy estimation'*. This time she carried out her plan and got the correct solution.

Angela demonstrated some metacognitive skills by constantly monitoring her moves while planning for a solution. She jumped stages after realizing that her first solution was wrong. However, she stuck by trial and error and never thought of any other alternative strategy for solving the problem. When asked about solving the problem using algebra, she commented that she had studied algebra and simultaneous equations, but *'never thought about algebra'* at that time. She managed to write the correct algebraic equations for this problem. These two cases show the important role played by metacognition in bringing about success in mathematics problem solving of students on top of their basic mathematics skills, problem-solving skills and their characteristics.

CONCLUSION

This research generates several findings. The overall performance of students declines drastically as the level of difficulty of problems increases. However, only students with good PMR results are able to maintain their performance as the level of difficulty increases. There is a statistically significant gender-related difference in mathematics ability in favor of female, based on the higher overall mean score. Racial-ethnic differences in mathematics achievement are very pervasive; large differences remain between the mathematics achievements of Chinese students, Malay students and Iban students. There is also a consistent disparity in mathematics achievement that is related to the socioeconomic status of these students. These students do employ the four phases problem solving – "Understanding a problem", "Devising a plan", "Carrying out" and "Looking back". Some of them do regulate their thinking process or employ metacognitive skills in the process of solving mathematics problems.

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APPENDIX

Figure 1: Framework Emphasizing the Dynamic and Cyclic Nature of Problem- Solving Activity

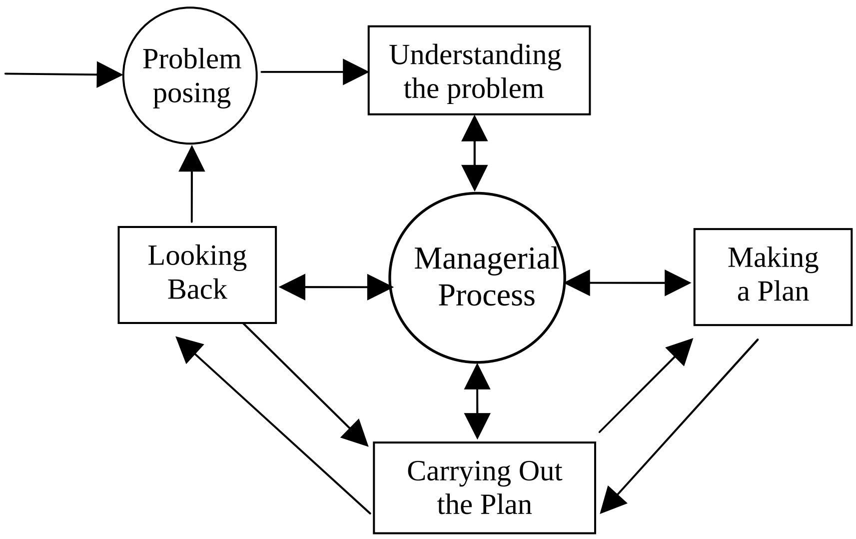

Table 1: Distribution of Students' Achievement of different Levels of Difficulty

Level of Difficulty	Achievement						Total	
	Low		Moderate		High			
	N	%	N	%	N	%	n	%
Level 1	100	24.3	141	34.2	171	41.5	412	100
Level 2	220	53.4	121	29.4	71	17.2	412	100
Level 3	323	78.4	56	13.6	33	8.0	412	100
Level 4	387	93.9	18	4.4	7	1.7	412	100

Table 2: Distribution of Achievement in different Levels of Difficulty by PMR Results

Level of Difficulty	PMR Results	Achievement						Total	
		Low		Moderate		High			
		n	%	N	%	N	%	n	%
Level 1	A	3	7.0	7	16.3	33	76.7	43	100
	B	4	7.4	17	31.5	33	61.1	54	100
	C	19	16.1	45	38.1	54	45.8	118	100
	D	56	33.9	61	37.0	48	29.1	165	100
	E	16	53.5	11	36.7	3	10.0	30	100
Total		98	23.9	141	34.4	171	41.7	410	100
Level 2	A	3	7.0	13	30.2	27	62.8	43	100
	B	14	25.9	24	44.4	16	29.6	54	100
	C	51	43.2	53	44.9	14	11.9	118	100
	D	126	76.4	26	15.8	13	7.9	165	100
	E	25	83.3	4	13.3	1	3.3	30	100
Total		219	53.4	120	29.3	71	17.3	410	100
Level 3	A	21	48.8	7	16.3	15	34.9	43	100
	B	34	63.0	15	27.8	5	9.3	54	100
	C	83	70.3	24	20.3	11	9.3	118	100
	D	155	93.9	9	5.5	1	0.6	165	100
	E	28	93.3	1	3.3	1	3.3	30	100
Total		321	78.3	56	13.7	33	8.0	410	100
Level 4	A	29	67.4	9	20.9	5	11.6	43	100
	B	50	92.6	3	5.6	1	1.9	54	100
	C	114	96.6	4	3.4	0	0	118	100
	D	164	99.4	0	0	1	0.6	165	100
	E	28	93.3	2	6.7	0	0	30	100
Total		385	93.9	18	4.4	7	1.7	410	100

Table 3: Achievement Differences in Different Levels of Difficulty By PMR Results

Level of Difficulty	PMR Results	Mean Score (15%)	Standard Deviation
Level 1	A	11.50	3.35
	B	11.10	3.38
	C	8.98	3.39
	D	7.42	3.49
	E	5.48	3.18
Level 2	A	10.23	3.63
	B	7.43	3.66
	C	5.87	3.53
	D	3.38	3.54
	E	2.17	2.95
Level 3	A	7.33	4.29
	B	4.39	3.54
	C	3.75	3.55
	D	1.72	2.31
	E	1.07	2.75
Level 4	A	3.86	3.83
	B	1.61	2.70
	C	1.08	1.96
	D	0.41	1.18
	E	0.67	1.56

Table 4: Distribution of Achievement in different Levels of Difficulty by Gender

Level of Difficulty	Gender	Achievement						Total	
		Low		Moderate		High			
		N	%	n	%	N	%	N	%
Level 1	Male	41	25.8	61	38.4	57	35.8	159	100
	Female	59	23.4	79	31.3	114	45.2	252	100
Total		100	24.3	140	34.1	171	41.6	411	100
Level 2	Male	93	58.5	34	21.4	32	20.1	159	100
	Female	126	50.0	87	34.5	39	15.5	252	100
Total		219	53.3	121	29.4	71	17.3	411	100
Level 3	Male	126	79.2	25	15.7	8	5.0	159	100
	Female	196	77.8	31	12.3	25	9.9	252	100
Total		322	78.3	56	13.6	33	8.0	411	100
Level 4	Male	149	93.7	6	3.8	4	2.5	159	100
	Female	237	94.0	12	4.8	3	1.2	252	100
Total		386	93.9	18	4.4	7	1.7	411	100

Table 5: Achievement Differences in different Levels of Difficulty By Gender

Level of Difficulty	Gender	Mean Score (15%)	Standard Deviation
Level 1	Male	8.17	3.63
	Female	8.90	3.91
Level 2	Male	4.98	4.50
	Female	5.45	4.01
Level 3	Male	2.98	3.38
	Female	3.31	3.76
Level 4	Male	1.10	2.40
	Female	1.16	2.24

Table 6: Distribution of Achievement in different Levels of Difficulty by Ethnic Group

Level of Difficulty	Ethnic Groups	Achievement						Total	
		Low		Moderate		High			
		n	%	n	%	N	%	N	%
Level 1	Chinese	8	17.8	15	33.3	22	48.9	45	100
	Malay	25	18.0	52	37.4	62	44.6	139	100
	Iban	65	29.4	71	32.1	85	38.5	221	100
	Others	2	28.6	3	42.9	2	28.6	7	100
Total		100	24.3	141	34.2	171	41.5	412	100
Level 2	Chinese	14	31.1	12	26.7	19	42.2	45	100
	Malay	66	47.5	48	34.5	25	18.0	139	100
	Iban	137	62.0	59	26.7	25	11.3	221	100
	Others	3	42.9	2	28.6	2	28.6	7	100
Total		220	53.4	121	29.4	71	17.2	412	100
Level 3	Chinese	34	75.6	5	11.1	6	13.3	45	100
	Malay	109	78.4	20	14.4	10	7.2	139	100
	Iban	175	79.2	31	14.0	15	6.8	221	100
	Others	5	71.4	-	-	2	28.6	7	100
Total		323	78.4	56	13.6	33	8.0	412	100
Level 4	Chinese	39	86.7	4	8.9	2	4.4	45	100
	Malay	127	91.4	9	6.5	3	2.2	139	100
	Iban	214	96.8	5	2.3	2	0.9	221	100
	Others	7	100	-	-	-	-	7	100
Total		387	93.9	18	4.4	7	1.7	412	100

Table 7: Achievement Differences in Different Levels of Difficulty By Ethnic Group

Level of Difficulty	Ethnic Group	Mean Score (15%)	Standard Deviation
Level 1	Chinese	9.32	3.68
	Malay	9.14	3.82
	Iban	8.14	3.79
	Others	8.71	4.19
Level 2	Chinese	7.89	5.12
	Malay	5.66	4.07
	Iban	4.43	3.80
	Others	6.29	5.35
Level 3	Chinese	4.40	3.83
	Malay	3.40	3.68
	Iban	2.74	3.38
	Others	3.18	5.35
Level 4	Chinese	2.27	3.14
	Malay	1.17	2.46
	Iban	0.88	1.93
	Others	1.00	1.41

Table 8: Distribution of Achievement in different Levels of Difficulty by Family Income Groups

Level of Difficulty	Family Income (RM)	Achievement						Total	
		Low		Moderate		High			
		n	%	n	%	N	%	N	%
Level 1	<500	57	25.0	88	38.6	83	36.4	228	100
	500<1000	22	23.9	28	30.4	42	45.7	92	100
	1000<1500	4	12.5	8	25.0	20	62.5	32	100
	1500<2000	2	22.2	2	22.2	5	55.6	9	100
	>2000	2	11.8	5	29.4	10	58.8	17	100
Total		87	23.0	131	34.7	160	42.3	378	100
Level 2	<500	130	57.0	66	28.9	32	14.0	228	100
	500<1000	54	58.7	23	25.0	15	16.3	92	100
	1000<1500	7	21.9	13	40.6	12	37.5	32	100
	1500<2000	5	55.6	2	22.2	2	22.2	9	100
	>2000	4	23.5	8	47.1	5	29.4	17	100
Total		200	52.9	112	29.6	66	17.5	378	100
Level 3	<500	182	79.8	29	12.7	17	7.5	228	100
	500<1000	77	83.7	11	12.0	4	4.3	92	100
	1000<1500	20	62.5	5	15.6	7	21.9	32	100
	1500<2000	9	100	0	0	0	0	9	100
	>2000	13	76.5	3	17.6	1	5.9	17	100
Total		301	79.6	48	12.7	29	7.7	378	378
Level 4	<500	219	96.1	7	3.1	2	0.9	228	100
	500<1000	88	95.7	3	3.3	1	1.1	92	100
	1000<1500	25	78.1	4	12.5	3	9.4	32	100
	1500<2000	9	100	0	0	0	0	9	100
	>2000	14	82.4	2	2	1	5.9	17	100
Total		355	93.9	16	4.2	7	1.9	378	100

Table 9: Achievement Differences in Different Levels of Difficulty by Family Income Groups

Level of Difficulty	Family Income	Mean Score (15%)	Standard Deviation
Level 1	<500	8.22	3.65
	500<1000	8.75	3.75
	1000<1500	10.69	3.49
	1500<2000	10.00	4.03
	>2000	10.47	3.63
Level 2	<500	4.81	4.02
	500<1000	4.90	4.04
	1000<1500	8.28	4.60
	1500<2000	6.00	4.77
	>2000	7.65	3.98
Level 3	<500	2.91	3.60
	500<1000	2.77	3.08
	1000<1500	5.38	4.70
	1500<2000	2.33	1.80
	>2000	3.94	3.09
Level 4	<500	0.73	1.79
	500<1000	1.13	2.20
	1000<1500	2.81	3.75
	1500<2000	0.89	1.62
	>2000	3.59	3.64

Figure 2: Normal Probability Plot

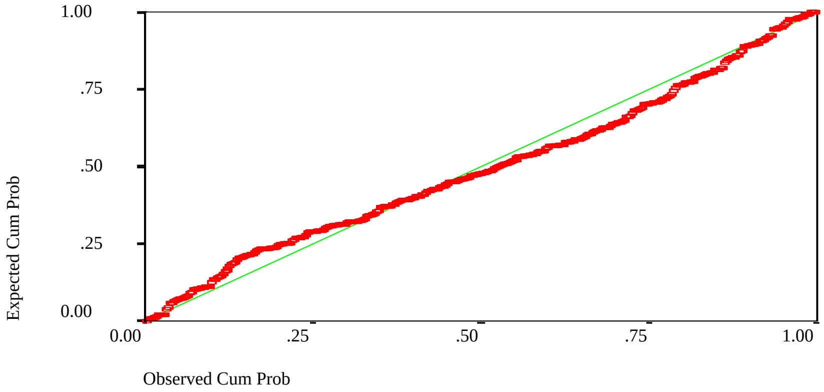

Figure 3: Residual Plot

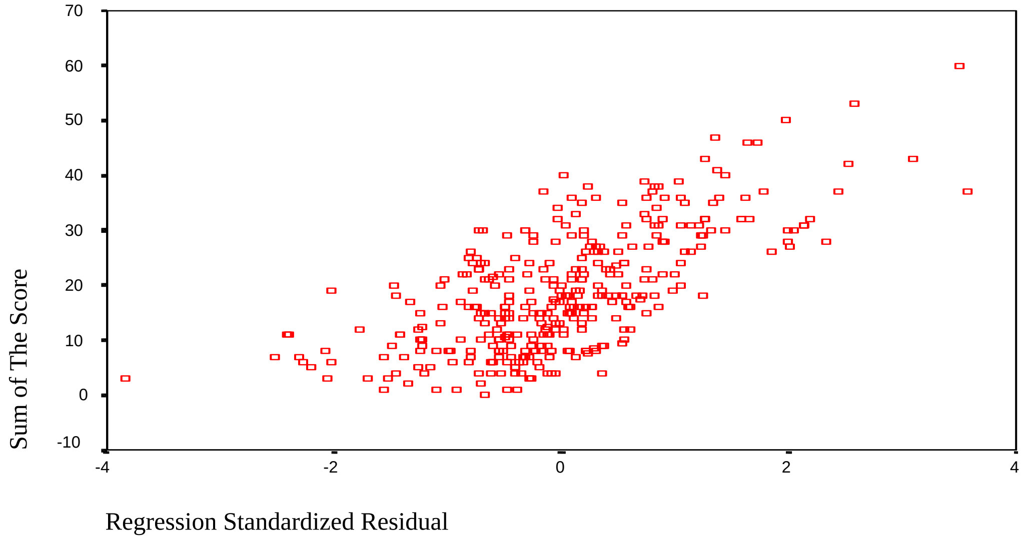

Figure 4 : Time-line Graph of Simon's Problem Solving Processes

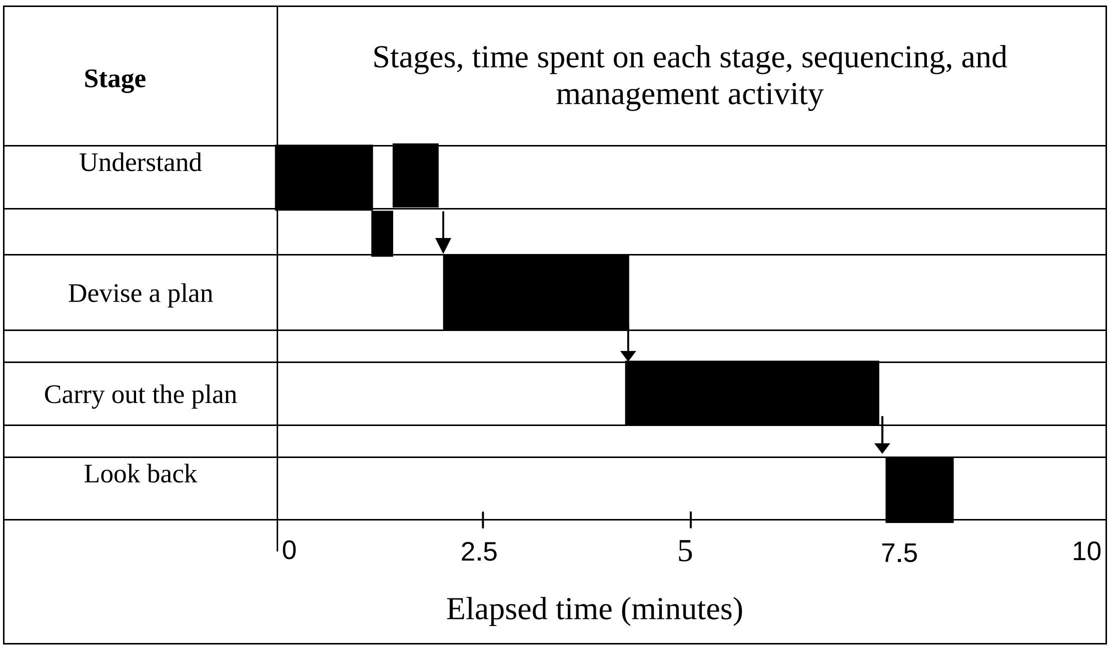

Figure 5: Time-line graph of Angela’s problem solving processes