To demonstrate the Serial Learning-positioning among Early adolescents and Late Adolescents

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Abstract

Learning is a process of living that enables us to move forward in life. Learning is much deeper than just recalling and memorizing. Learning done on a daily basis involves understanding, relating opinions and making connective links between the information learnt previously with the new information learnt recently. There are various forms in which learning can be practiced. The aim of this research is to study about the memory and learning ability of Early and Late adolescents with regards to the objectives set to be; to differentiate the learning ability of Early and Late adolescents as well as to adhere to the early psychological research that was done on the memory power of different stages of Adolescents. The hypothesis of this study is that there will be a significant difference in learning between Early adolescents and the Late adolescents. 60 samples were taken, 30 in each group. The methodology used in this study are 'serial leaning and serial positioning' which were used to demonstrate how individuals of different ages can recall information associated with time delay of 10 minutes between serial learning (orderly manner) and serial positioning (disorderly manner). The groups were Early Adolescents and Late adolescents from an educational institute located around the college campus. Adolescents with physical disabilities were not included in the study and all the adolescents in this study are from an English medium institution. For the results, Standard deviation and t-test were used to score.

The study was proven that Late adolescents have higher memory recall ability compared to that of the early adolescents.

Keywords- Learning, memory, Cognitive Development, Adolescents, Serial Learning and Positioning

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Chapter- I

INTRODUCTION

1.1 INTRODUCTION

Education is the key to life, and the process of promoting learning, acquisition of knowledge, skills, values, beliefs, and habits. Many of the key elements for effective peer learning are often incorporated in the design of small collaborative learning groups, and research shows that students who engage in collaborative learning and group study perform better academically and have enhanced self-esteem said Landis (2000). Learning has always been and will always be a key to achieve and to grow in life. "If learning is what we value, then we ought to value the process of learning as much as the result of learning" by Jensen (1998).

Learning is a complex process that involves a wide variety of factors. It is also a robust function that changes our nervous system in relation to the stimuli from the environment, which leads to changes in our behavior and helping us to operate in the surrounding environment.

Memory is the encoding, storage, and retrieval in the human mind of past experiences and it is a result of and an influence on perception, attention, and learning. Both Learning and memory go hand in hand that influence our behavior and act as a crucial part of the human life. There are various ways in which individual learn a lot of aspects and try

keeping it in their memory and recall but at times we as humans tend to forget minimal things. For instance, where we put the glasses or what did we wear yesterday.

Over the centuries several Psychologists; Richard Atkinson and Richard Shiffrin (1968), Hermann Ebbinghaus (1850), Elizabeth Loftus(1970s), Jerome Raaijmaker and Richard Shiffrin (1981), have been trying to explain the process of learning and forgetting who have tried to explain as in how our minds encode and decode information. One of which is the Verbal memory, that refers to memory of words and other abstractions involving language according to 'Cognitive Psychology' (Ulric Dick Neisser, 1967).

1.2 HISTORICAL BACKGROUND

The research study of memory has been in existence over the centuries which played a major aspect in the field of Cognitive psychology. The study of human memory reverts back at least 2,000 years to Aristotle's early attempts in understanding memory in his commentary "On the Soul". In this commentary, he compared the human mind to a blank slate and speculated that all humans are born free of knowledge and that they are simply the summary of their experiences. Aristotle (350 BC) compared memory to making impressions in wax, sometimes referred to as the "storehouse metaphor", a theory of memory which held sway for many centuries. The 18th Century English philosopher David Hartley was the first individual to contemplate that memories were encoded through hidden motions in the nervous system, although his physical theory for the process was rudimentary at best. William James in America and Wilhelm Wundt in Germany, both considered among the founding fathers of modern psychology carried out some early basic study into how the human memory functions in the 1870s and 1880s. Although, there were various psychologists, philosophers and neurologists like Théodule-Armand Ribot, Wilder Penfield, Donald Hebb have worked on the study of memory and brain, the change in the overall study of memory during the 1950s and 1960s has come to be known as the "cognitive revolution", and led to several new theories on how to view memory, and came up with influential books by George Miller (1960), Eugene Galanter (1966), Karl Pribram (1991), George Sperling Sperling, George (1967) and Ulric Neisser (1976). In 1956, George Miller published his influential paper on short-term memory, his assessment said that the human short-term memory is limited to what he

called "the magical number seven, plus or minus two". And, Endel Tulving's study of the human memory in the 1970s has been highly inspiring. Moreover, he was the first to introduce two distinct kinds of long-term memory, episodic and semantic, in 1972 and he also devised the encoding particularity principle in 1983.

In today's study, human memory is considered as a part of the development of cognitive psychology and neuroscience. Therefore, the interdisciplinary connection between the two is known as cognitive neuroscience.

1.3 TYPES OF MEMORY

- Sensory Memory: Sensory memory Is the shortest form of memory. Sensory memory acts as a defense for stimuli received through the five senses i.e. sight, hearing, smell, taste and touch which are precisely retained, but very briefly which was given by Sperling George (Successive approximations to a model for short term memory, 1967). For instance, the ability to look at something and then remembering how it looked like in half a second is an example of Sensory Memory.

- Short-term Memory (working memory): Short-term memory is the ability to remember, a small amount of information in the mind in an active state for a short period of time. For example, making a mental list before we head to a supermarket, it's our short-term memory that helps us recall the items we made a list of.

- Long-term Memory: Long-term memory is the brain's system for storing, managing, and recalling information. It is very complex with various functions. Hypothetically, the holding ability of the long-term memory is unlimited which can contain for a few minutes or a lifetime. (Atkinson-Shiffrin, 1968)

- Explicit Memory: Explicit memory is also referred to as 'conscious memory' which is basically a premediated recall of information.

  For example, every time we fill up a college application, we consciously recall our address, phone number etc.

1.4. **Memory and Learning**

Learning and memory are inter-related concepts. Learning is the achievement of skill or knowledge, while memory is the interpretation of what you've acquired. Another difference is the speed with which the two things happen. For instance, if you acquire the

new skill or knowledge slowly and laboriously, it is known as learning. If acquisition occurs instantly, that's making a memory. Learning is an important element of human behavior. Throughout the human lifetime learning is constant. (American Psychological Association)

- Verbal Learning: Is a process of retaining and remembering verbal material; which involves the language we speak and the communication devices we use. Signs, symbols, words, pictures, figures, sounds, are the tools used in such activities.

- Concept Learning: Concept learning requires high order thinking processes like intelligence, thinking and reasoning.

For instance, a ball, we learn that the term ball refers to a particular object that we play with or is used to play.

- Discrimination Learning: Learning to differentiate between motives and showing an appropriate response to these motives is called discrimination learning.

Example, the barking of a dog to the meowing of a cat.

- Motor Learning: This learning involves our day-to-day activities to maintain a good coordination of muscles every time we make a move.

Example, Running, climbing, walking etc.

1.5. Verbal Learning-Serial Learning and Positioning

Verbal learning is a process of learning about verbal stimuli and responses such as letters, data, nonsensical syllables, or words. It is a process of acquiring, retaining and recalling of verbal material. The first process of Verbal learning is "Serial Verbal Learning" which involves a list of items (words or syllables) that people engage in while learning those words and try maintaining it in an orderly manner. While experimenting, Psychologists ask the subject to read a list of items and then produce this list while keeping the original order of items. Ebbinghaus came up with a strategy to remember the items in an orderly manner that deals with building connections between those words, he named this strategy as "serial anticipation method". Studies of this type of learning have also discovered the serial position effect, which is the second process of Verbal Learning that the different parts of the list are learnt in different stages of difficulty. Generally, the first few items are the easiest to learn while the last items of the list are the hardest to learn. According to Ebbinghaus, some items are said to be the easiest to recall while the others are the

hardest, which means that the first few items have primacy effect and final items have recency effect, respectively (Murdock, 1992). The Serial Verbal Learning and the Serial Position learning play a major role in understanding the memory of an individual.

1.6. Importance of Serial learning & positioning on early and late adolescents

Adolescence is the transitional period from childhood to adulthood.

Late adolescents tend to recall better than that of early adolescent as cognitive development begins to take place during the ages 12 to 18 which basically means that an adolescent's brain activity involving memory, thinking and reasoning is still under the process of development. Early adults tend to be good at memorizing a large chunk of information because they've already completed the stage of cognitive development.

The cognitive development in Early Adolescent

● They try to use complex thinking and begin to make personal decisions

● Start learning systematic and logical reasoning at School

The cognitive development in Middle Adolescent

● They already develop their ability to use more complex thinking while solving problems

● Try to influence and adjust to with others around them

The cognitive development in Late Adolescent

● Have already developed thoughts about more global concepts, such as justice and politics.

● Tries to develop optimistic views on specific topics or concerns

● They develop the ability to debate and get habituated to intolerance of opposing views

By the time an individual has reached the stage of late adolescence, their cognitive growth had already become an adult in thinking, reasoning and memory. (Cognitive development in teen years, 2019)

Therefore, this thesis deals with how there was a significant difference between early adolescents and late adolescents during the serial-learning and positioning of words in association with their memory. It is also a compilation of all the aspects associated with Learning and Memory with relation to time. The aim of the study is to prove that Late Adolescents have higher learning memory compared to the Early Adolescents.

Chapter-II

REVIEW OF LITERATURE

2.1. INTRODUCTION:

Review of Literature consists of the studies conducted by previous researchers. Numerous studies have been conducted on Serial Learning; the studies relevant for this dissertation are presented as under.

2.2. STUDIES IN RELATION TO SERIAL LEARNING.

- Hermann Ebbinghaus is credited with conducting the first study of verbal memory which involves serial learning. Most serial learning studies use a strategy called "serial anticipation", where one stimulus is presented one by one and the learner uses that word as a cue for the next word. The second word then plays a role of a cue for the third, and so on. One of the most rational findings in research involving single words or nonsense syllables involves the 'serial position function' or serial position effect: learners show greatest recall for stimuli at the beginning of the list, and good but somewhat the lowest recall for items appearing at the end of the list. Stimuli in the middle is fair enough compared to that of the last items of the list. When learners must remember single words or nonsense syllables in free recall, the greatest recall often occurs at the end of the list, with proper but lower recall at the beginning. If the words to be learned are meaningfully related, such as those in a sentence, people tend to remember them by using serial anticipation, even when they are allowed to use free recall. The first seven items in a list are often effortless to learn. This fact is consistent with the research that indicates that, regardless of the type of learning, humans can remember "the magic number seven" items without relying on rehearsal or other mnemonic strategies.

- A study on "Serial learning by rhesus monkeys: I. Acquisition and retention of multiple four-item lists." was conducted by Swartz, K. B., Chen, S., & Terrace, H. S. (1991) in the Journal of Experimental Psychology: Animal Behavior Processes.

Two rhesus monkeys were trained to learn eight 4-item lists, each composed of 4 different photographs. Lists were trained in successive phases: A, A----B, A----B----C, and A----B----C----D. After List 4, retention, as measured by the method of savings, was, on

average, 66% (range: 44-84%). Indeed, all 4 lists could be recalled accurately during a single session with neither a decline in accuracy nor an increase in the latency of responding to each item. Latencies to Item 1 of a subset varied directly with the position of that item in the original list. During the acquisition of Lists 5-8, both Monkeys' mastered the A----B and A----B----C phases of training in the minimum number of trials possible. In this study done by Swartz, K. B., Chen, S., & Terrace, H. S it is stated that the monkeys that were tested did good in recognizing the list one after the other after a few trial sessions. This study also proves that, learning is crucial in life, be it in humans or in animals. Through learning and practice, one can improve in recall and improve their brain development.

- This study was carried forward by Michael J. Kahana, University of Pennsylvania 2010. The test was done to determine how the consistency of positional information across multiple study–test trials influences serial learning. This was accomplished by comparing serial learning under standard constant starting position conditions with serial learning under variable starting position, or spin, conditions (The participant had to recall words varied from the starting position of the list). They found that people can learn short, medium, and long spin lists, but that they do so more slowly than control lists. Although this difference was statistically robust, it was modest in magnitude (e.g., Cohen's $d = 0.47$ for the trials-to-criterion measure). This analysis revealed that participants show significantly more losses in the spin condition versus the control condition, and that there is no stable difference in gains between the conditions. Thus, the current gains across trials were significantly greater in the control condition compared to the spin condition. This was true even when conditioning on lists that participants initiated correctly. Therefore, it appears that interference between the starting positions across trials cannot fully be accounted for participants' difficulty in learning spin lists.

- This study was initiated by Rossi-George and Rovee-Collier, 1999. The test was done to determine that retroactive interference is rare or nonexistent in studies of infant visual recognition memory (Rose et al, 2007) but common in conditioning studies of infant long-term memory. Three-month-olds who were exposed to a novel mobile immediately

after training, for example, recognized it but not the original one 24 h later. With the passage of time, the retroactive interference dissipated, and infants again recognized only the original mobile 48 h later (Gulya et al., 2002).

This study basically states that, our memory keeps updating. So, the retroactive interference dissipates if a new cue is not encountered, however, the time window within which updating can occur also decreases until the details of the original cue are forgotten (Rovee-Collier et al., 1994) or the memory is reactivated later (Galluccio and Rovee-Collier, 2005).

- A.F. Healy, W.J. Bonk, in Learning and Memory: A Comprehensive Reference, 2008. An early description of serial learning was based on an associative chaining model wherein one item in a sequence was linked to (associated with) the next item in a chain (Crowder, 1968). This model was a natural process of the serial learning task involving the method of anticipation in which each item in the list is notably given as a cue for the next item. "In our example of the list ABCDEF, the letter A would be linked to the letter B, B to C, and so on. However, even for that task, the simple associative chaining model may not be appropriate, as is evident intuitively from the observation that missing one item in a serial list does not lead to failure to report all subsequent list items." The reason why one missing item cannot disrupt the flow of the following items is that, people are well acquainted with the alphabets and they are definitely not new to them. However, it is not the same with random unknown words or items.

The study of A.F. Healy, W.J. Bonk was all based on Hermann Ebbinghaus's serial anticipation which is basically using the previous item as a cue for the next item. This strategy was also used by the Late adolescents in my study. They used the serial anticipation method to recall the list of items. While the Late adolescents were quick at recall, the Early Adolescents took time to recall because of their brain being still under development.

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METHODOLOGY

3.1- PARTICIPANTS:

The sample consists of 30 Early adolescents, and 30 Late adolescents taken from different schools, colleges and workplaces. People with illness, visual impairment, disabilities were not considered as subjects for this research project.

3.2- HYPOTHESIS:

Late adolescents perform better compared to Early Adolescents.

3.3 OBJECTIVES:

- To know that there will be a significant difference in serial learning and positioning between early and late adolescents.
- To know the overall significant difference level among the Early and Late Adolescents.

3.4 APPARATUS:

Materials used in this experiment are a list of 24 simple words that people use in everyday life. The 24 set of words were divided into two different sets with 12 in each set. The apparatus was designed by the experimenter.

The first set of words are BAG, SUN, CAT, FOUR, READ, BANK, STUDY, GRIEF, BROWN, BEAUTIFUL, WONDERFUL, PRINCIPAL. These set of words were used for the Early Adolescents.

The second set of words are GUM, SON, GOT, TELL, FIVE, FAME, GOALS, CHAIR, MADAM, CHEERFUL, GRACEFUL, MERCIFUL. These set of words were used for the Late Adolescents.

Each word was placed on different cards; similar to that of which Hermann Ebbinghaus has proposed in his study.

3.5 VARIABLES:

Serial Position effect was used-

3.5.1- Independent Variable- cards shown to the subject

3.5.2- Dependent Variable- response given by the subject.

3.6 PRECAUTIONS:

1. The groups were divided evenly according to the age factor.

2. It was made sure that the samples were not disclosed of the material before the experiment was conducted.

3. The test was conducted in a noise free environment

3.7 PROCEDURE:

The samples were taken from a Government English medium school which is located at Mallapur, Hyderabad. The environment at the school was calm and pleasant to conduct the test.

The samples were explained about the experiment and the purpose of the data collection. They were made to sit in a quiet room which was noise free and the following instructions were given. "There are few cards with me, a word written on each card. Every card will be shown for few seconds one after the other and try to remember them in an order." The cards were shown thrice and few moments were given for a break before taking samples' responses. The responses were taken. Similarly, the test was done on both Early and late adolescents respectively; responses were noted down. The test went smoothly without any disturbances and the faculty of the school were very welcoming. Then the responses were calculated and standard deviation method was used to know the overall result.

3.8 SAMPLING TECHNIQUE

The sampling technique used in this experiment is "stratified sampling". In this method, the target groups were divided into sections according to the age group. Then each section was sampled individually.

The target groups for this study were Early adolescents and late adolescents, respectively.

3.9 DATA ANALYSIS

Descriptive statistics was used for the study. The entire research samples were measured and calculated by standard deviation and T-test. The mean of two samples are (1) -2.8 and (2) -0.73. The standard deviation of the two samples is 2.80.

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RESULTS

4.1- RESULTS:

The results are obtained by scoring and t-test was used. The tables below show the detailed information about the overall scoring of samples. (N=60).

4.1.1 Table -1 Shows participant details.

The participants were a group of 30 Early Adolescents

And a group of 30 Late Adolescents

S. No	Participants	Samples	Age
1	30	Early Adolescents	12-14yrs
2	30	Late Adolescents	19-24yrs

4.1.2 Table-2 Shows the result of serial position effect in Early adolescents and Late adolescents. Both the groups are adolescent groups with both male and female samples.

S. No	Items	Early Adolescents	Late Adolescents
1	Mean	-2.8	-0.73
2	Observations	30	30
3	Standard Deviation	2.80	
4	T-test	-2.95	

The result of the serial position effect in Early and late adolescent resulted in the mean of -2.8 for Early Adolescents and -0.73 for Late adolescents. The standard deviation is 2.8 that gave us a T-test score of -2.95. The T-test score is below the degree of freedom i.e. @0.05 and

@0.01 as shown in the table below. Therefore, Null hypothesis is rejected and the Alternative Hypothesis is accepted.

4.1.3 Table-3 Showing T-test value and Degree of Freedom

Degree of Freedom	@0.05	@0.01
58	2.00	2.58
T-test	-2.95	

4.2 DISCUSSION

The aim of the study was to find out how Early adolescents and late adolescents perform in serial learning and positioning. The experiment was carried forward with everything well planned and organized manner. The responses were noted down. Based on the responses, the mean, standard deviation, Standard deviation error, T ratio and the degree of freedom was found as mentioned in the above tables. The result of these findings show that there is a significant difference between the scores of the Early adolescents and the Late adolescents. The T ratio is less than the degree of freedom which states that the null hypothesis is rejected and the alternative hypothesis is accepted.

Table 1 states that the study consists of two groups Early adolescent and the other Late Adolescent. The Early Adolescents vary from ages 12 to 14 years while the Late adolescents vary from ages 19 to 24 years.

In the Table 2 we see that the mean of Early Adolescents is -2.8 and -0.73 for Late adolescents. The standard deviation is found to be 2.8. The degree of freedom is 58. The T-test score after calculations was found to be -2.95 which is less than the level of significance 0.05 and 0.01. Since the T ratio is less than the degree of freedom, the Null hypothesis is rejected and the Alternative Hypothesis is accepted. Which states that the Late adolescents perform better compared to the early adolescents. According to Herman Ebbinghaus, the adolescents showed the greatest recall for the items appearing at the beginning of the list and the lowest recall at the end of the list. Ebbinghaus also stated that people tend to make the second card a cue for the third and it goes on till the end which he also named it as Serial Anticipation. The serial Anticipation was used by the late adolescents but the Early adolescents lacked in this technique as their mind is still under development as mentioned earlier in the study. Also, the late adolescents were known to be faster in recall after being

distracted by some short activities or environmental disturbances. But, the early adolescents took longer than the late adolescents to recall the 12 set of words after being distracted.

The Late adolescents are better in serial positioning effect compared to Early adolescents. During adolescence, the neurocircuitry strengthens and allows for multitasking, enhanced ability to solve problems, and the capability to process complex information which also means that throughout the stages of Adolescence the brain keeps developing and adjusting to the things young people come across. By the time they have reached early adulthood, their brain starts to function in a wider range by multitasking with various situations simultaneously. The development and maturation of the prefrontal cortex occurs primarily during adolescence and is fully accomplished at the age of 25 years. The development of the prefrontal cortex is very important for complex behavioral performance, as this region of the brain helps accomplish executive brain functions. (US National Library of Medicine National Institutes of Health, Maturation of the adolescent brain, 2013).

In a study by Alliance excellent education (2018), they stated that during the adolescent stages, there is a lot of change that occurs in their brain. Some lack learning skills and some develop learning skills during this time. The major findings of this study was that adolescents need to be trained well in order to cope with the upcoming stages of life. Basically, the students in middle and high school need chances to develop deeper learning competencies, such as problem solving and critical thinking, and other higher-order thinking skills to support application of those skills later in life. Therefore, education leaders must ensure that learning opportunities support the development of adolescents. With relation to this study, the early adolescents need some more attention on how they could cope up with their learning and recalling skills which can make them develop their thoughts and ideas on the basis of learning as well as co-curricular activities that can help them improve their cognitive growth and explore various aspects of the society.

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CONCLUSION

5.1 SUMMARY

The study of this research document is to demonstrate the serial learning-positioning among Early adolescents and Later adolescents. We chose this topic to find out if there would be any significant difference on memory among the two target groups since they are closely related. The hypothesis of this study is, the late adolescents perform better in serial-positioning compared to early adolescents. The experiment was put forth by 24 meaningful words which were divided into two sets,12 in each set. The apparatus was designed by the experimenter. The participants of this study were Early adolescents and Late adolescents 30 in each group, which makes it 60 in total. The materials used were a pencil and few set of papers. The target groups were divided into sections and the test was done individually in a separate room without any kind of hindrance. The 24 words were the key elements of this experiment and through those 24 words, the response were noted down. Based on the responses, the mean, standard deviation, standard deviation error, T ratio and the degree of freedom were found. The T ratio was less than the degree of freedom which means that the null hypothesis is rejected and the alternative hypothesis is accepted. Through this study and the scoring, it was found that there is a significant difference between the Early and Late adolescents. This study contributes to knowledge and understanding of adolescents as well as in improving the wellbeing of adolescents in a wider range.

5.2 CONCLUSION:

The results prove the hypothesis that there is a significant difference in Serial Learning and positioning between the Early and Late Adolescents as seen in the samples. Furthermore, Late Adolescents have higher recalling ability when it comes to serial learning and positioning compared to that of Early Adolescents. Through the t-test we found that the null hypothesis is rejected which means that the Late adolescent's cognitive development is higher than Early Adolescents.

5.3 LIMITATIONS:

1. The study is limited to city of Hyderabad

2. The study is limited till the age group of 24

3. The study is limited to educated individuals only

5.4 IMPLICATIONS:

It contributes to knowledge and understanding of adolescents, helps to improve individual wellbeing, and how an individual can help adolescents develop their skills in learning and memorizing.

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APPENDIX

Unused sample Sheets of serial learning and positioning on Early and Late Adolescents that
was used for 30 samples.

Early Adolescents

S.no	Key words	Responses for Serial-learning	Responses for Positioning
1	BAG		
2	SUN		
3	CAT		
4	FOUR		
5	READ		
6	BANK		
7	STUDY		
8	GRIEF		
9	BROWN		
10	BEAUTIFUL		
11	WONDERFUL		
12	PRINCIPAL		

Late Adolescents

S.no	Key words	Responses for Serial-learning	Responses for Positioning
1	GUM		
2	SON		
3	GOT		
4	TELL		
5	FIVE		
6	FAME		
7	GOALS		
8	CHAIR		
9	MADAM		
10	CHEERFUL		
11	GRACEFUL		
12	MERCIFUL		

Scoring Sheet (Early Adolescents)

Sample No.	X1	(X1-M1)	(X1-M1)2
1	-1	1.8	3.24
2	-1	1.8	3.24
3	-6	-3.2	10.24
4	-9	-6.2	38.44
5	-9	-6.2	38.44
6	-3	-0.2	0.04
7	0	2.8	7.84
8	-6	-3.2	10.24

9	-8	-5.2	27.04
10	-9	-6.2	38.44
11	2	4.8	23.04
12	1	3.8	14.44
13	0	2.8	7.84
14	-3	-0.2	0.04
15	0	2.8	7.84
16	-7	-4.2	17.64
17	-1	1.8	3.24
18	-6	-3.2	10.24
19	-1	1.8	3.24
20	0	2.8	7.84
21	-5	-2.2	4.84
22	-1	1.8	3.24
23	-2	0.8	0.64
24	-3	-0.2	0.04
25	0	2.8	7.84
26	-2	0.8	0.64
27	0	2.8	7.84
28	0	2.8	7.84
29	-6	-3.2	10.24
30	0	2.8	7.84
-86		323.6	
M_1=-2.8			

Scoring Sheet (Late Adolescents)

Sample No	X2	(X2-M2)	(X2-M2)2
1	-1	-0.27	0.0729
2	-1	-1.73	2.9929
3	-3	-3.73	13.9129
4	-1	-1.73	2.9929

5	0	-0.73	0.5329
6	0	-0.73	0.5329
7	0	-0.73	0.5329
8	-1	-1.73	2.9929
9	-4	-4.73	22.3729
10	-2	-2.73	7.4529
11	2	1.27	1.6129
12	0	-0.73	0.5329
13	-3	-3.73	13.9129
14	1	0.27	0.0729
15	-1	-1.73	2.9929
16	1	0.27	0.0729
17	0	-0.73	0.5329
18	-3	-3.73	13.9129
19	0	-0.73	0.5329
20	-2	-2.73	7.4529
21	-2	-2.73	7.4529
22	-3	-3.73	13.9129
23	1	0.27	0.0729
24	0	-0.73	0.5329
25	-1	-1.73	2.9929
26	1	0.27	0.0729
27	-1	-1.73	2.9929
28	-2	-2.73	7.4529
29	2	1.27	1.6129
30	1	0.27	0.0729
-22		133.187	
M2=		-0.73	