Chapter Six: Presentation and Discussion of the Findings

In this chapter, a presentation in table and graph form will be made of the results of the entire study to demonstrate the movement from syncretic responses to being guided by the concrete to the emerging ability to solve the problem posed by the blocks from an increasingly developed conceptual perspective.

The table below graphically presents the total adapted Hanfmann and Kasanin (1942) score for each subject in this cross-sectional study. Each subject appears in the table as M (male subjects) and F (female subjects), purely for interest and not because of any attempt at gender analysis. However, for the reader's interest, the subjects discussed at length in Chapter Five appear bolded in the table.

Total score	3-year-old subjects	5-year-old subjects	8-year-old subjects	11-year-old subjects	15-year-old subjects	Adult subjects
36					**F** M**	F F F **M M M**
35					F M	
34						F
33						**F**
32					F **M****	
31					M** M	**M**
30				**M**		**M**
29						
28						
27				**M**	F	
26			**F**			
25				**F**** F**		
24					F	
23				F F**		
22			**M**	M		
21			**M**	M		
20						
19		**F**				
18			F			
17				F		
16			F F			
15		F	F**	M		
14		**M**				
13			M**			
12		**M*****	M			
11		**F** F				
10			M			
9		F* M M				
8						
7	**F**					
6	**F F F F F F**	M*				
5	**F M M**					
N=60 (Scoring range between 5 and 36)						

Table 18: Adapted (Hanfmann & Kasanin, 1942) Total Scores for all Subjects

=Game terminated; **=Repetition/resorting did not take place; *=Own game*

The table above showed far more clearly than I had expected a movement from the responses of the

three-year-old subjects up (most steadily) to those of the adults.

The figure below depicts a scatter graph of each age category in relation to the adapted Hanfmann and Kasanin (1942) overall group scoring. The three-year-old subjects are represented by the category 1; the five-year-olds as category 2; and so on up to the adult subjects as category 6.

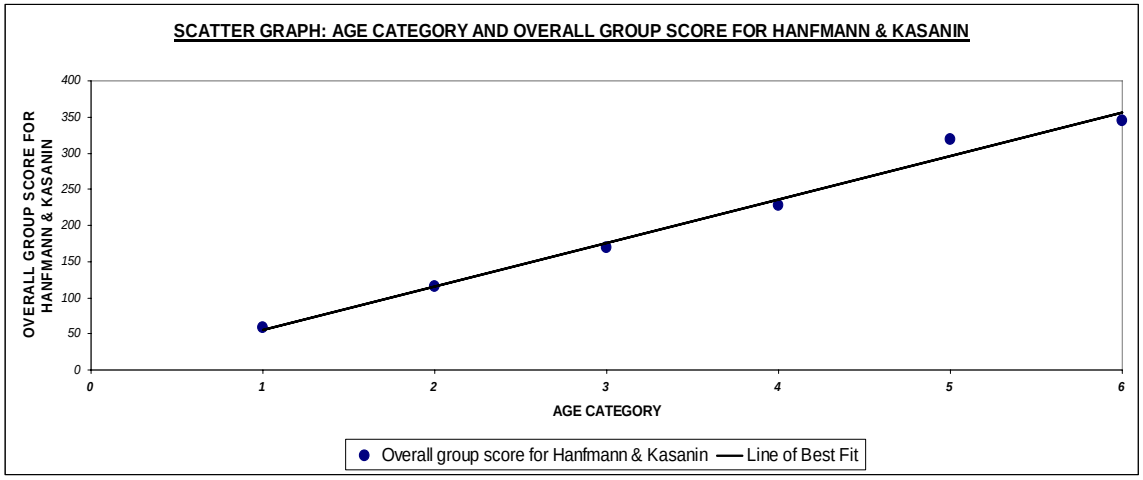

Figure 3: Adapted (Hanfmann & Kasanin, 1942) Overall Group Score and Line of Best Fit

As can be seen in the scatter graph above, the correlation indicated by the line of best fit is approximately linear, and indicates a positive correlation where, as the age group increases, so do the adapted Hanfmann and Kasanin (1942) overall group scores increase steadily and systematically.

The bar chart below depicts each age category in relation to the adapted Hanfmann and Kasanin (1942) overall group scoring as percentages of the maximum possible total (360).

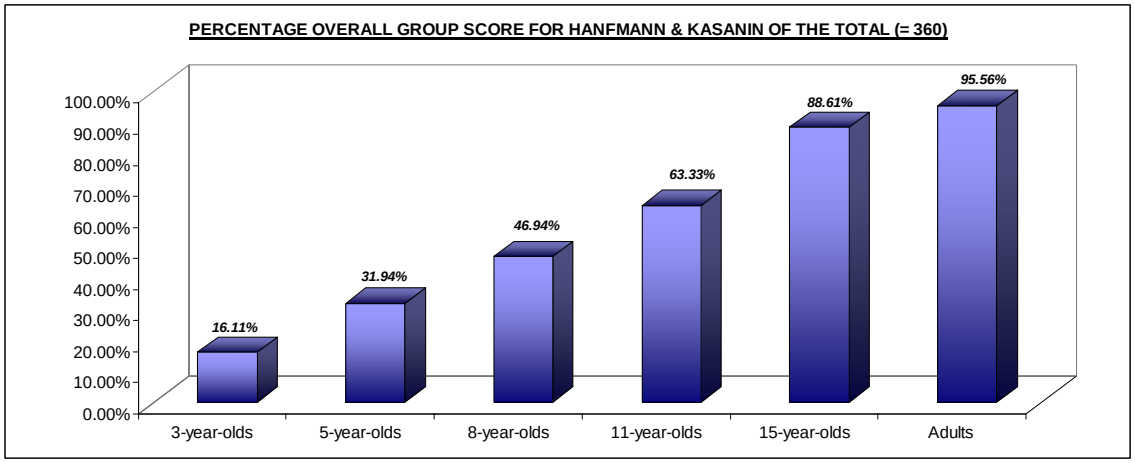

Figure 4: Adapted (Hanfmann & Kasanin, 1942) Overall Group Score as a Percentage of the Maximum Possible Total of 360

As can be seen in the bar chart above, the percentage increases per age group from the three-year-old subjects through to the eleven-year-old subjects are between 15% and 16%, and the most marked increase is that between the eleven-year-old subjects and the adolescents at just over 25%: this increase is exactly where Vygotsky (1986) predicted it would be. Interestingly, there was not a great gap between the fifteen-year-olds and the adults.

The next table (below) graphically presents each subject in terms of their score for the adapted category "Levels of Performance" (LoP) of Hanfmann and Kasanin (1942).

LoP score	3-year-old subjects	5-year-old subjects	8-year-old subjects	11-year-old subjects	15-year-old subjects	Adult subjects
12					**F** M**	F F F **M M M**
11					F M	
10					F **M****	F **F M M**
9				**M**	F F M** M	
8			**F**	**F**** F** **M**		
7				F F**		
6			**M M**	F		
5		**F**		M M		
4		**M*****	F F F** F	M		
3		**F** F F **M**	M**			
2			M M			
1		F* M M				
-1	**F**					
-2	**F F F F F F**	M*				
-3	**F M M**					
N=60 (Scoring range between -3 and 12)						

Table 19: Adapted (Hanfmann & Kasanin, 1942) Levels of Performance Scores for all Subjects

=Game terminated; **=Repetition/resorting did not take place; *=Own game*

Although the Levels of Performance was fully one third of the possible maximum total in terms of the Hanfmann and Kasanin scoring, it showed an obviously similar upward trend to that of the graphic table and the graphs of the full scores (Table 18 and Figures 3 and 4).

This section – Levels of Performance – most clearly depicted the conceptual modes (or preconceptual ones) that subjects of different ages would tend generally to employ when solving a problem – or learning a new concept – in terms of Vygotsky's assertion of what the method of double stimulation allows to be seen in concept and language development when "freed from the directing influence of the linguistic milieu" (1986, p. 120).

In relation to the scoring graphically depicted here, it is interesting to note that with concrete and explicit intervention, only two five-year-old subjects of eight were able to benefit from this intervention; one of the eight-year-olds did not (out of three), and the only eleven-year-old who received intervention was not able to benefit from it. All of these subjects scored 6 or below in the category of Levels of Performance.

The figure below depicts a scatter graph of each age category in relation to the adapted Hanfmann and Kasanin (1942) Levels of Performance score for each age group.

Once again, the three-year-old subjects are represented by the category 1; the five-year-olds as category 2; and so on up to the adult subjects as category 6.

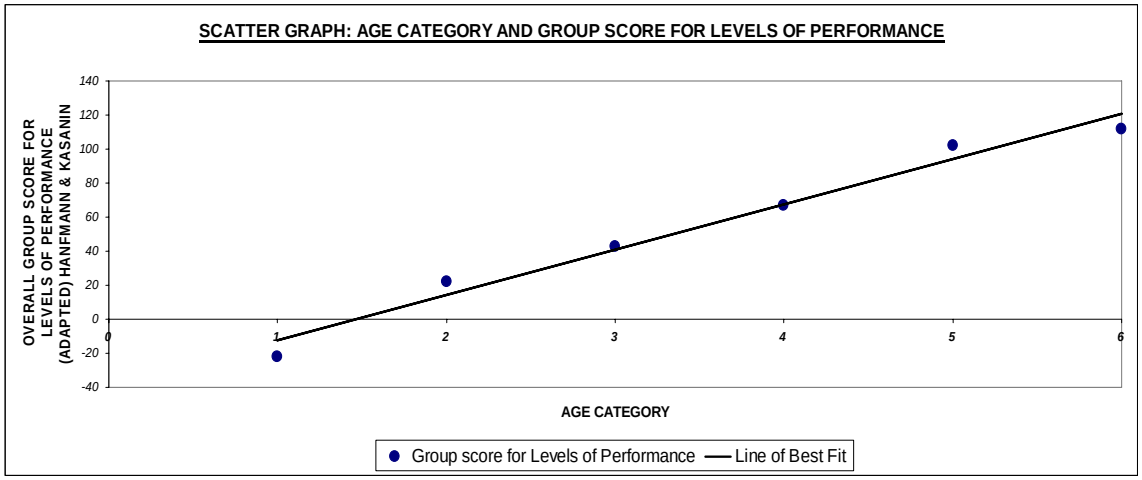

Figure 5: Adapted (Hanfmann & Kasanin, 1942) Group Levels of Performance Score and Line of Best Fit

As can be seen in the scatter graph above, once again, the correlation indicated by the line of best fit is approximately linear, and indicates a positive correlation where, as the age group increases, so do the adapted Hanfmann and Kasanin (1942) group Levels of Performance scores.

The bar chart below depicts each age category in relation to the adapted Hanfmann and Kasanin (1942) group Levels of Performance scores as percentages of the maximum possible total (120).

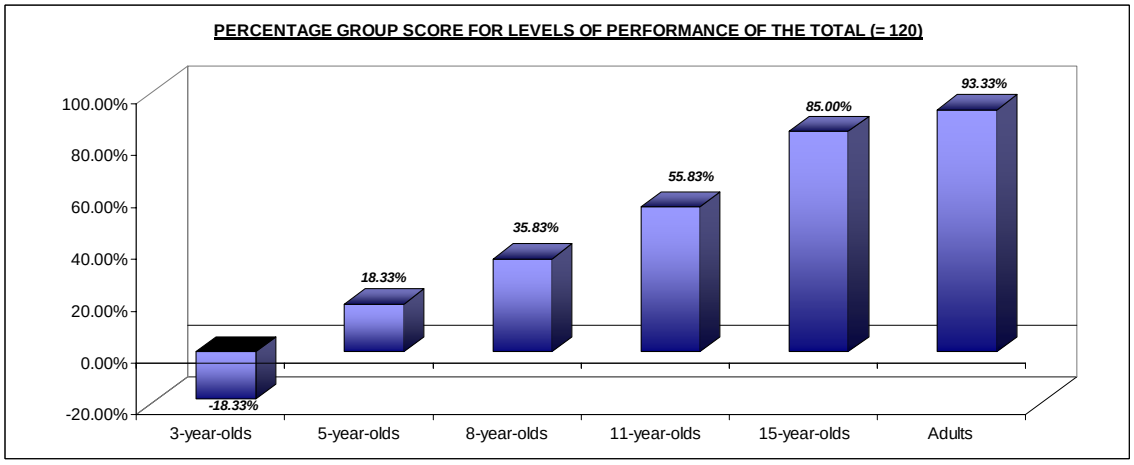

Figure 6: Adapted (Hanfmann & Kasanin, 1942) Group Levels of Performance score as a Percentage of the Maximum Possible Total of 120

As can be seen in the bar chart above, there are two major increases. The first is that between the three- and five-year-old subjects at just over 36%. I interpret this increase to be in part because of the function of the words *cev*, *bik*, *mur*, and *lag*, to which the five-year-olds paid far more attention than did the three-year-olds, as well as because five of the five-year-olds made associative connections and collections, and where one subject was able to focus with remarkable consistently on size.

However, the increase of nearly 30% between the eleven-year-old subjects and the adolescents is of greater significance, and indicated very clearly the mode of thought at which the adolescents were operating compared to the eleven-year-olds.

The table below shows the coefficient of variation of the adapted Hanfmann and Kasanin

(1942) total scores per subject per age group.

No. of Respondents per age group	3-year-old subjects	5-year-old subjects	8-year-old subjects	11-year-old subjects	15-year-old subjects	Adult subjects
1	7	19	26	30	36	36
2	6	15	22	27	36	36
3	6	14	21	25	35	36
4	6	12	18	25	35	36
5	6	11	16	23	32	36
6	6	11	16	23	32	36
7	6	9	15	22	31	34
8	5	9	13	21	31	33
9	5	9	12	17	27	31
10	5	6	10	15	24	30
Arithmetic Mean Score	5.8	11.5	16.9	22.8	31.9	34.4
Standard Deviation	0.60	3.53	**4.68**	4.21	3.75	2.20
Coefficient of variation	0.10	**0.31**	0.28	0.18	0.12	0.06
Coefficient of variation (%)	10.34	**30.68**	27.68	18.48	11.77	6.40
(N=60) Scoring range between 5 and 36						

Table 20: Coefficient of Variation of Adapted (Hanfmann & Kasanin, 1942) Total Scores for all Subjects

As can be seen in the table above, the highest variability in responses was in the five-year-old subjects and not in the eight-year-old subjects as initially perceived by the absolute standard deviation comparison (these figures are bolded in the table). Additionally, the variability in responses from the eight-year-old subjects was much higher than that of the eleven-year-old subjects.

The table below showed the coefficient of variation of the adapted Hanfmann and Kasanin (1942) Levels of Performance scores per subject per age group.

No. of Respondents per age group	3-year-old subjects	5-year-old subjects	8-year-old subjects	11-year-old subjects	15-year-old subjects	Adult subjects
1	-3	5	8	9	12	12
2	-3	4	6	8	12	12
3	-3	3	6	8	11	12
4	-2	3	4	8	11	12
5	-2	3	4	7	10	12
6	-2	3	4	7	10	12
7	-2	1	4	6	9	10
8	-2	1	3	5	9	10
9	-2	1	2	5	9	10
10	-1	-2	2	4	9	10
Arithmetic Mean Score	-2.2	2.2	4.3	6.7	10.2	11.2
Standard Deviation	0.60	1.89	**1.79**	1.55	1.17	0.98
Coefficient of variation	-0.27	**0.86**	0.42	0.23	0.11	0.09
Coefficient of variation (%)	-27.27	**85.76**	41.67	23.17	11.43	8.75
(N=60) Scoring range between -3 and 12						

Table 21: Coefficient of Variation of Adapted (Hanfmann & Kasanin, 1942) Levels of Performance Scores for all Subjects

Once again, as can be seen in the table above, the highest variability in responses was in the five-year-old subjects and not in the eight-year-old subjects as initially perceived by the absolute standard deviation comparison (these figures are bolded in the table). Further, the variability in responses from the eight-year-old subjects was much higher than that of the eleven-year-old subjects.

The table overleaf graphically presents the number of blocks turned before the solution was arrived at for each subject (taken from the supplementary scoring of Hanfmann and Kasanin's (1942) scoring method). Some explanation of this table is required before presenting it (for your reference, please turn to the next page where the table appears as you read though the explanation provided here). The top half of this graphic table showed the subjects who required fewer turned blocks – or clues – before they arrived at the solution. All ten adult subjects and four of the adolescents fell into this top half of the table, because they had given every indication that the solution they had arrived at was the only logical one that created four groups without exceptions or inconsistencies. In this respect, then, when the remaining blocks were turned over, these merely served to confirm their solution, and, as such, were not scored.

By contrast, the subjects in the bottom half of the table did not demonstrate this degree of certainty about their solution, and the remaining blocks which were turned over served as growing confirmation for what they had suspected might be the solution. For this reason, the number of turned over blocks in the cases of these subjects was counted as correctly placed blocks (indicated in the table by a number followed by a slash and the next number, showing the number of incorrectly placed blocks or clues to the correctly placed blocks or confirmatory ones). The bottom half of the table is a mirrored reflection of the top half, where in the bottom half of the table, the subjects placed closer to the bottom required fewer turnings of the blocks before the confirmatory turnings began.

Six of the adolescent subjects fell into this lower part of the table, as did five of the eleven-year-old subjects and one eight-year-old subject. With the exception of the adolescents in this part of the table, two eleven-year-old male subjects and one eleven-year-old female subject noticed height and size fairly early on into their sessions, as did the eight-year-old female subject. Further, of two of the five-year-olds subjects who required ten to eleven blocks to be turned over, the first noticed size almost immediately, and the second did so increasingly during her session: both of these five-year-old subjects were being guided by what was perceptually obvious to them, and described their groupings according to either height or size but not both characteristics.

Twenty subjects (one third of the total) required 21 blocks to be turned over, and in 16 of these cases, (all ten of the three-year-olds; three of the five-year-olds; two of the eight-year-olds; and one of the eleven-year-olds), the combination of height and size as the solution remained 'undiscovered'.

The reasons for three of the five-year-old subjects being in the top half of the table were because, for two of them, the game was terminated and the number of turned blocks was included in their scores at that time, and for one of them, the number of turned blocks was counted and scored up until the stage where the 'rules' of his game took over.

What is of great interest in the way this table graphically depicted the responses from the 60 subjects in this study was that with the obvious exception of the 'syncretically' dominated three-year-olds, not one of the five-, eight- or eleven-year-olds subjects fell into the top half of the table. Five of the five-year-olds and seven of the eight-year-olds required between 21 and 14 turned blocks or clues, as did five of the eleven-year-olds (as can be seen from the middle of the table to about one third down).

As noted earlier, Vygotsky and Sakharov believed that introducing the means of the solution gradually (with the turning up of the blocks) "permits us to study the total process of concept formation in all its dynamic phases" (1986, p. 104).

Turned blocks	3-year-old subjects	5-year-old subjects	8-year-old subjects	11-year-old subjects	15-year-old subjects	Adult subjects
0/2					**M**	
0						
1						**M**
2						
3		F*			**F**** M**	**M** F
4						
4/7						F
5						
5/1						**M**
6		M*				
7					**M****	F
7/1						F
8						**M**
9						
9/1						**F**
9/2						**M**
10						
11		**M*****				
12						
13						
14						
15						
16						
17						
18						
19						
20						
21	**F F F F F M M F F F**	**F M** M M	F** M	F F** F M		
20/1			F			
19/2						
18/3		F	M**			
17/4			F			
16/5			M			
15/6				**M**		
14/7			**M**			
13/8						
12/9						
11/10		**F** F				
10/11						
9/12			**M**			
8/13			F			
7/14					F F	
6/15						
5/16				F** **M**	M	
4/17				**F****	F F	
3/18				M	M	
2/19				M		
1/20			**F**			
N=60 (Scoring range from 0 correctly turned blocks to 1 correctly and 20 confirmatory)						

Table 22: Hanfmann & Kasanin (1942) Supplementary Scores for all Subjects (numbers of incorrectly and correctly turned blocks)

=Game terminated; **=Repetition/resorting did not take place; *=Own game*

My interpretation of this response from the five- and eight-year-olds is that, as Vygotsky envisaged, these children's mode of thinking was in the realm of the concrete and factual, as opposed to the logical and abstract. The range of responses from the eleven-year-old subjects reflected, by my interpretation and observations, the emergence of increasing numbers of ideas as possible solutions existing side-by-side with the concrete and factual (indeed, the eleven-year-old subject who advanced the greatest number of possible solutions, inconsistently applied as they were, relied on 15 blocks to be turned over, whereas the next highest scoring subject in this age group relied on far fewer and did not entertain or advance anywhere near as many possible solutions).

I believe this trend continued on as reflected in the positions in this table of the adolescent subjects, who, in advancing greater numbers of increasingly sophisticated solutions, were also moving away from the perceptually dominated into the conceptual. I believe that the explanation for this is also a crucial theoretical assertion of Vygotsky's: the function of 'the word', of language, that enabled these subjects to increasingly engage with conceptual exploration, an exploration not possible with the younger subjects in this study.

Taken together, the findings depicted above lead me, firstly, to agree with Hanfmann and Kasanin (1942) and Fuad Topić (2006) that the main indicator of true conceptual thinking is the understanding or taking into account what is referred to as "the totality". The first of the younger subjects in this study to demonstrate his appreciation of his moves in relation to the totality was an eleven-year-old (S1107M). This appreciation of the totality was found in the cases of four of the adolescents who scored 3 in this category, and by four more (score of 2) who were able to note that they were aware of inconsistencies. All of the adult subjects scored 3 in the category of the totality.

In this respect, understanding what was required of the task, including the implications for one's movements of the blocks in relation to the totality, is part and parcel of the first subsection of the Hanfmann and Kasanin scoring. The interpretation of the task, of understanding what the activity requires, these authors note, determines in large measure how the activity would be accomplished (1942, pp. 20-21).

This statement sounds obvious, but, in the context of this research exercise with Vygotsky's Blocks, was the clearest indication of how a subject would be likely to approach the task using the mode of thinking and approaches that they had at their disposal and were predisposed to rely upon. It was possible for younger subjects to solve the problem of the blocks by using a combination of being guided by the words and the blocks themselves, which is what the functional method of double stimulation is all about. However, the subjects' initial approaches to the activity demonstrated very clearly whether they were approaching it with true conceptual thinking or with the need to be guided by the concrete and the perceptual.

Secondly, this study showed the initial movement away from the syncretic and subjective interpretations that young children made towards an emerging ability to be guided by the perceptual and the concrete that enabled them to solve the problems posed by the blocks by way of the complexive associations they were making.

This movement was followed by an increasing ability to abstract certain characteristics from the blocks (beyond the immediate ones of shape and colour), and to combine these observations with others to try to figure out why the blocks belonged in certain groups and not others. This step appeared to mark the beginning of abstract thought, and was obvious in the movements and explanations that the subjects gave: it became increasingly evident that, with maturation and a movement towards thinking about combining ideas, this 'action' was taking place more inside the

subject's head, as opposed to being involved with the immediacy of the given moment of the more physical engagement with the blocks evidenced with younger subjects. The subjects who displayed this ability to focus on one abstracted idea – height, for example – also seemed to sense that it needed to be combined with some other element of the blocks in order to solve the problem or find out what the groups were. All of this movement was accompanied by an increasing ability to take in the 'bigger picture': to hold in one's understanding the instructions about the need for four groups, and to let this activity take place inside one's head, rather than relying on simply manipulating the blocks and turning them over.

Although the eleven-year-olds were, on the whole, able to abstract one characteristic of the blocks, like height, their combinations with the other elements tended back towards the perceptually and concretely inspired obvious traits like colour or shape. Their emerging ability to explore ideas before they touched the blocks, or while they were doing it, was evident in their movements and the expressions on their faces. But this appeared to be a new ability, and the complexities required to consistently, logically and conceptually remember which characteristic combinations had been tried and did not work, and the seeking of new characteristics appeared still to be beyond some of them. They were 'peeling away' as it were, from the perceptually and concretely obvious, into the world of ideas. This trend continued into the group of adolescent subjects, and culminated in the close range of responses from the adult subjects.

Finally, the trends depicted in the appropriate tables and figures above, most particularly those which show the greatest increase between the eleven-year-old subjects and the fifteen-year-old subjects, were *exactly* where Vygotsky predicted they would be. Because this study was a cross-sectional one it enabled me to see with clarity Vygotsky's argument regarding the development of concepts in human beings, worth citing here in full:

> The principal findings of our study may be summarized as follows: The development of the processes that eventually result in concept formation begins in earliest childhood, but the intellectual functions that in a specific combination form the psychological basis of the process of concept formation ripen, take shape, and develop only at puberty. Before that age, we find certain intellectual formations that perform functions similar to those of the genuine concepts to come. With regard to their composition, structure, and operation, these functional equivalents of concepts stand in the same relation to true concepts as the embryo to the fully formed organism. To equate the two is to ignore the lengthy developmental process between the earliest and the final stages. (Vygotsky, 1986, pp.105-106)