

## **Cognitive Intervention-Based Assessments: Piagetian Screening**

By Steve Valdez, Ph.D.

*Editor's Note: This article is an example of one school psychologist "thinking outside the box." Please notice that this explains the personal experience of Dr. Valdez; the California Association of School Psychologists does not endorse recommendations made in this article.*

### **General Considerations**

There is a national impetus within school psychology to conduct more frequent brief assessments that are relevant to instructional interventions (formative evaluation). This article will summarize brief cognitive screenings that are, in many circumstances, efficient for indicating instructional and curricular modifications to make academic and other interventions more effective.

Many psychologists and educators receive training in Piagetian theory as part of their professional preparation. Piagetian assessment is likely to be familiar to psychologists working in districts that routinely conduct alternative assessment of cognitive ability. For example, the psychologists at the Southern California Diagnostic Center use the Ordinal Scales for in depth Piagetian assessment.<sup>1</sup> For many school psychologists, Piagetian screening or assessment is a departure from the routine of standardized intelligence testing.

Standardized intelligence testing may diagnose a student's expectancy for academic achievement. However, such testing takes considerable time and generally cannot be done more than once a year. This limits its usefulness as pretest/post-test for short-term interventions. Standardized cognitive scores quantify the strength or power of a student's processing or abilities. This quantification has not reliably predicted which intervention methods are most likely to be successful.

Curriculum-based measurement (CBM) probes can be used several times a year. CBM is often used by school psychologists or others for pretest/post testing the effectiveness of interventions. However, CBM does not tell us why an intervention is or is not successful, nor is it diagnostic for the prescription of instructional modifications. Piagetian screening, however, can be helpful in guiding instructional interventions, especially with math concepts and comprehension. I have also found it helpful with certain difficulties in written composition and social interaction.

Rather than quantify strengths, Piagetian theory explains the stage wise development of qualitatively, different ways of thinking and the process of development from stage to stage. By gaining such an understanding of a student's thinking, we can understand why students experience learning difficulty. Piagetian screening can provide a quick estimate of a student's cognitive developmental level. My experience suggests it is useful to select from the following five Piagetian tasks: a) Conservation of Length (emerging concrete operations, during age 5); b) Conservation of Number (early concrete operations, age 6); c) Conservation of Liquid (middle concrete operations, age 7); d) Classification (upper concrete operations, age 9); and e) the Kohlberg Scale (Intuitive, concrete and formal operations, age 6 and up). **(See the end of the article for a brief explanation of the above tasks.)**

Piagetian tasks are signposts indicating the stage or level in which a child is functioning. Teaching a child to perform a specific task will not in and of itself change the child's stage of development. However, these signposts can help us to craft modifications and accommodations that support a match between the student's cognitive processing ability and the curriculum. The following interventions were not systematically devised, but as a school psychologist I have improvised various interventions over the years. Selected examples of such interventions follow.

### **Presenting Problems and Instructional Interventions**

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<sup>1</sup> For a more information on this subject, consult work by Harvey Gurman and Diana Browning Wright

## **Math**

Teachers often refer students because of apparent difficulty remembering how to do math operations after specific systematic one-to-one and small group instruction. In order to understand the numeric concepts of addition and subtraction, the students should have attained conservation of number, so if remembering how to accurately do simple addition or subtraction is the presenting problem, I give a conservation of number task.

A child who has not attained conservation of number, may be able to state, perform or memorize various procedures for simple addition or subtraction, but often will become confused when trying to do the same operation, hours, days or weeks later. This is because human memory stores information in two ways, as verbatim representations and gist representations. According to modern theories of memory development, memories are stored as exact input (verbatim) or as concepts or meaning (gist) and these memory representations are accessed independently. See Brainerd and Reyna (2002) for a brief explanation of theory. A child, who has not attained conservation of number, doesn't have the conceptual framework for one-to-one correspondence because they don't yet have invariance of quantity. Inability to perform math operations, again, at a later time, often gives the impression of being a memory problem, even in the absence of a general memory deficit. Often the problem is that the child has not attained the developmental stage needed to understand that math concept. In this case the child may store verbatim memories but not memory for the gist (conceptual knowledge).<sup>2</sup>

Before making suggestions for intervention, I give a conservation of length task to make sure that the level of concrete operations is emerging. If not, the child is probably at the intuitive stage of pre-operational thinking. Interventions can be directed to help the child accelerate from the intuitive stage to emerging concrete. For example, ask the child's parents if their child went through a stage where they asked a lot of questions and at what age this occurred. This "*why stage*" typically happens around age 4 and is involved in learning cause-effect thinking. Primary school-age children who are not yet intuitive thinkers, have often arrived at the "*why stage*" a year or two late and may not have had their questioning behavior reinforced.

For children who are **NOT** yet in the intuitive thinking stage, I suggest to the parents that they ask their children a lot of why questions and encourage their children to ask such questions, in the context of their daily activities. Questions and answers provide a natural and effective discovery format to stimulate the dialectic advancement from one Piagetian stage to the next. Explaining cause-effect phenomenon in the child's world can also be helpful. For agrarian culture immigrant families, extensive conversation with children may be a foreign idea and often needs further explanation in terms of cultural and social class differences.<sup>3</sup>

For children who have attained conservation of length but not conservation of number, interventions may be remedial and accommodative. Parents and teachers can be encouraged to play number conservation games with their children with objects that have value to the child. For example, M & Ms can be used to do variations on the conservation task, but with slightly unequal amounts and lesser amounts in each set (4 & 3). While the child is in the process of attaining conservation of number, do not expect them to understand or remember the math operations they have had difficulty learning. In the interim, they will require patient reminders to use one-to-one correspondence, and can memorize math facts with flash cards and auditory drills.

In my experience, some children have attained the developmental stage needed to understand curricular concept but do not apply that logic to solve the problem. Often children,

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<sup>2</sup> Verbatim representations are memories of exact inputs, i.e., facts, procedures, while gist representations store patterns, concepts, senses. Verbatim representations fade more rapidly and become less accessible than more durable gist memories.

<sup>3</sup> e.g.: Value for talking vs. doing, cultivation of language development vs. spontaneous emergence, didactic vs. rhetorical questioning & educational vs. entertainment toys.

who have only recently attained concrete operations, find it easier and may prefer to use intuitive reasoning. Screening for intermediate-term auditory and visual memory deficits may be in order for a few of these children. I also consider whether the child may have artistic cognitive style if there is evidence of creativity and talent. Some intuitive style thinkers can and do use logical thinking, but prefer to intuition as their primary mode of thinking. They tend to free associate, which allows them to be creative. However, intuitive thinkers may experience difficulty in the conventional educational setting of logical sequential thinkers.<sup>4</sup>

When a teacher asks for help with a child who does not seem to be able to retain regrouping procedures (borrowing & carrying) when doing multiple digit addition and subtraction, I suggest that the psychologist try a simple conservation of liquid task with the child. This task requires the student to use three-dimensional logic as she or he does the traditional procedures for borrowing and carrying. Again, I give a conservation task (number) at the next developmentally lower stage to verify that the student is functioning within concrete operations and has the use of linear logic.

In the case of a student who has not attained conservation of liquid volume but has attained linear logic, a common accommodation would be to use Touch Math. However, Touch Math does not readily help the child move to the next stage and understand the curricular concept of regrouping. I have suggested modifications in the computation method with some success. Start with addition, break the process down for the student into two separate problems, a tens problem and a unit problem. Solve and combine into a third problem. At home, convert the problem into dimes and pennies, add and convert back. Reinforcing the use of pennies vs. nickels or dimes can be accomplished with vending machines and small purchases at the store. The same methods can then be applied to subtraction. An abacus is an excellent learning tool, but it needs to be something that the student's group uses regularly or that is used at home regularly. Many years ago, and at a particular school, I was able to initiate a Korean method of counting, Tninkling, started in a kindergarten wing and in some classrooms. This method eliminated regrouping difficulties for all students functioning above the retarded range. Unfortunately, the method was so foreign that I could not convince teachers above second grade to use it, though I understand that it also facilitates multiplication and division.

### ***Comprehension***

General difficulties with comprehension of curricular concepts in 4th through 8th grade are not an infrequent complaint. Though such difficulty is both common and complex, the Piagetian task of classification can rule out whether the student has not attained the developmental stage to comprehend concepts that involve partially overlapping sets.

While the international modal age for attainment of the classification task is during age 9, there is considerable upward variance. Many upper elementary science, social studies and literary concepts are not only in black and white but in shades of gray, and involve mental manipulation of the interaction of these three.

It has been my experience that many of the students who experience difficulty with partially overlapping sets in the curriculum are emerging into the stage where they can comprehend these concepts. In the emergent phase, students do not on their own figure out these ideas, but with specific and explicit instruction can comprehend such complex concepts. This is best accomplished in small group, with extra help from the teacher during breaks, before and after school, by parents and by School-Based Coordinated Programs.

Accommodations are suggested for students who have attained conservation of liquid, but not an overlapping sets classification task. I have suggested modified credit for tests and assignments, and to get extra help with homework. Most of these students will reach the stage where they understand the ramifications of partially overlapping sets in a matter of months or a year, at which time they will easily comprehend more complex curricular concepts. In the

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<sup>4</sup> For further information, see R. Sternberg's Triarchic Theory of Intelligence.

meantime, their confidence, motivation and academic self-respect should at least partially be protected.

### **GATE**

Teachers sometimes refer students who have difficulty with conceptual information in comparison to other GATE students. In many districts students admitted to GATE programs after referral and IQ testing have demonstrated exceptional cognitive capacity processing speed and crystallized intelligence. A Piagetian screening may indicate that the student, who was referred by the teacher, is at the expected stage for their chronological age but not at the level of their GATE peers. In this case, I generally suggest that the GATE teacher make accommodations for this student.

Conversely, some students who do not qualify for GATE on standardized intelligence tests may be precocious in terms of stage-wise cognitive development. I have found that such students are likely to benefit from curricular enrichments that conceptually extend the curriculum to higher levels of Bloom's Taxonomy but should not be expected to compete with GATE students in terms of speed and quantity of production.

### **Older Students**

I have not often had need of a screening task for formal operations, and, therefore, have not adopted one for school use. When the need has arisen, I have relied on the "Organizer" from the Learning Potential Assessment Devise (LPAD).<sup>5</sup>

### **Social Development**

Students often come to the attention of school psychologists because of issues with social behavior. I have found an adaptation of the Kohlberg Scale to be a useful tool for counseling or consultation in many cases; especially when conduct and conflict issues are involved. The Kohlberg Scale provides a description of levels of moral development corresponding to cognitive development attainment from the intuitive stage to formal operations. Some psychologists include moral development assessment as a component of emotional intelligence." Even when this measure is informally used, care should be taken to insure informed consent for screening is obtained.

It has been my experience that, students at Kohlberg Stage 1 respond better to behavior modification techniques than to other methods. Students at Stage 2 have a sense of fairness and equity. Counseling should appeal to this sense of fairness with close attention to follow through when contracts are implemented. Students who experience family dissolution at this stage often perceive that the world has not been fair to them and may decide not to be fair in return. Stage 3 is the level where talk counseling becomes more effective, because the student can be helped to empathize with the feelings and perceptions of others and grasp others perceptions of them. At Stage 4, the parents and counselor can appeal to the students; understanding of the need for social order. I have rarely experienced a student at Stage 5 who is experiencing significant conduct problems outside of civil protest. However, it is possible for a person to give lip service to higher levels while functioning at a lower level one. In my experience, the latter pattern as been associated with sociopathology.

It is not unusual for learning disabled students' judgment (right vs. wrong) to lag slightly behind their cognitive development. This is an opportunity to assist these students in bringing their ethical development up to speed with their cognitive development.

### **Conclusion**

I started informally using variations of the Kohlberg scale in 1974 and Piagetian tasks in 1977. In my experience, there are many nuances to the application of Piagetian theory to

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<sup>5</sup> Feuerstein, Rubeen; Miller, Ronald; Rand, Ya'acov; Jensen, Mogens. "Can Evolving Techniques Better Measure Cognitive Change?" The Journal of Special Education, Vol. 15, No. 2, 1981. Hadassah-WIZO Canada Research Institute, Jerusalem, Israel.

educational interventions that I have not begun to write about. There are others who use Piagetian tasks and the reader may find their work helpful in developing one's own approach. These techniques are not to be followed in a cookbook fashion and are not intended to be applied outside of an understanding of Piagetian theory. Some may want to look up their old text on Piagetian theory, as well as current cognitive developmental theory, and freshen up a bit before making applications to casework. Hopefully, some of my colleagues will find this article helpful.

**Box:**

**PIAGETIAN LEVELS of DEVELOPMENT**  
(Cognitive Domain)

<u>Level</u>	<u>Stage</u>	<u>Quality of Thinking</u>
Pre-Operative	Associative	Association based on coincidentally occurring events. Classifies Egocentric. Limited differentiation of reality from fantasy. Discriminates size and quantity.
	Intuitive	Rudiments of cause-effect reasoning based on perceptions. Association based on function. Egocentric. Incomplete differentiation between reality and fantasy. Seriates.
Concrete Operations	Early	Able to use three-dimensional logic to override perception. Differentiation of reality from fantasy. Beginning symbolic reasoning. Consistent one-to-one correspondence.
	Middle	Able to use three-dimensional logic. Can articulate thinking strategies. Able to imagine the viewpoint of others.
	Upper	Able to sequentially consider multiple factors. Able to work with partially overlapping sets and conditions of inclusion, exclusion and mutuality.
Formal		Full capacity to use abstract logic. Reasons by principles.

Note: The dialectic of assimilation -- accommodation from stage to stage is not described in this article.

**TASKS:**

The tasks described below are the basic tasks that I have found more efficient to use than more complex versions.

**Conservation of Length**

For a conservation of length task, I use two pieces of yarn of equal length (approx. 2'). For convenience, one is red and the other yellow. I place the two pieces straight, parallel and less than half an inch apart on a table in front of the student. I ask if each has the same length of yarn. If the student answers "no," then probe to clarify -- sometimes the student has language acquisition issues, processing delays or he/she may be at a preconceptual level. If the student answers "yes," then I leave one string straight and coil the other and ask if each piece still has the same length of string (just as much). An affirmative response tends to indicate that concrete operations are emerging. Children at this stage often have difficulty explaining when

subsequently asked "why?" An inability to explain does not necessarily mean that the student has not attained emerging concrete operations. Yes/no queries may provide clarification.

### **Conservation of Number**

For a conservation of number task, I prefer to use two sets of 11 to 13 small blocks. I find it convenient to have each set a different color (e.g. 11 red blocks & 11 blue blocks). I show & tell the student that I am making two lines of blocks (one to two inch spacing). For each red block I put a blue block so that the positioning of opposing blocks on the two lines of blocks matches. Then I ask, "Are there more red blocks, blue blocks or the same number?" The student usually responds that they are the same. If the student responds, "no", try to clarify. If the response is still "no," stop because the child may not have conservation of number. Next, spread out the blocks in one of the lines on the table to at least double its original length, and collapse the other line into a small area. Ask, "Now, are there more red blocks, blue blocks or the same? After the child responds, ask why, and what will happen if we spread out the blocks again. A child who responds that there are now more in one of the sets (unequal) has not attained conservation of number (linear logic). Probe with additional questions if the child's response is not clear, especially if language development issues obscure the communication.

### **Conservation of Liquid**

A simple conservation of liquid task is easily presented to students with two little paper cups (like those dispensed on water coolers) and a much wider transparent container. I have the students put the same amount of water (equal to their satisfaction) into the small cups by filling them to the top. I check for agreement that they are equal and then pour the contents of one of the cups into the wider container. I then query by asking: 1) if there is still the same amount of water in each container, 2) if one now has more and why, and 3) what will happen if we pour the water back. To demonstrate conservation of liquid, the child must demonstrate invariance (amounts did not change), compensation (understanding that the water in the wider container is lower in height because the container is wider and the water has spread) and reversibility (when poured back into the original cup, the water will return to its original height). More complex conservation tasks are involved at higher stages within the level of concrete operations. I generally have not used these, but if you have found applications for them, please let me know. More complex tasks may help to understand a child's capacity for multiple dimensional sequential reasoning needed to understand long division. I suspect that the logic associated with the classification task is involved, but the relationship has not yet made itself obvious enough to be useful in consulting with teachers regarding interventions.

### **Classification Task**

I use a simple math problem as a classification task. I tell the students that I have a math problem for them. For the naive, I say a "tricky" math problem. The student is asked to read the problem as follows:

3 Red Roses

1 Yellow Rose

2 Red Carnations

1 Yellow Carnations

Are there more roses or red flowers?

When they first read the word "roses," I ask them what is a rose. If they don't say, I supply that it is a kind of flower. When they first read the word "carnation" I repeat the procedure used for the roses and if the student seems not to understand, I refer to a familiar context in which they probably have seen a carnation. Then the student rereads and responds to the question. In order to clarify the nature of their response, I ask, "How many (their answer) are there?" Students, who have attained a stage of understanding partially overlapping sets, readily respond "red flowers" and upon query verify that there are 5. Students, who have not attained that stage, usually quickly respond "roses" and seem confident or very confused. In this case confusion is developmentally more advanced than certainty in the incorrect answer. An

emergent stage is indicated by students who initially respond incorrectly, but upon query figure out the correct response.

### **The Kohlberg Scale** (Adapted)<sup>6</sup>

The Kohlberg Stages of Moral<sup>7</sup> Development, which are ordinal in nature, have been demonstrated to have cross-cultural validity. The stage of the Kohlberg Scale at which a student responds can be included as qualitative data in individual assessments. This measure of cognitive development can be used in the context of counseling, classroom planning, parent consultation, and together with performance on Piagetian tasks, as a complementary, clinical or alternative assessment procedure.

The Kohlberg Scales use moral dilemmas. For individual assessments, rather than using the moral dilemmas, it is much faster to pose a simple question and prod for further responses as needed for clarification. Prod to find out if the student can reason at a higher stage; or if they are giving memorized verbiage from a higher stage that they have merely memorized, but they don't understand.<sup>8</sup> The stimulus question is, "Why is it wrong to steal?" If the student responds, "Because that's taking something that's not yours"; prod with, "Yes, but why is it wrong to take something that doesn't belong to you?"<sup>9</sup> This procedure usually takes about three minutes. The Kohlberg stages are listed below, with typical responses to the "stealing" question, and some examples of probing questions that can be used for clarification.<sup>10</sup> These examples are, merely, to give an idea of how this type of interview could be done. Age ranges are approximate.<sup>11</sup>

#### **Kohlberg Stages:**

1. Reward/Punishment and/or Authority, ages 4 to 6. Corresponds with the Preoperational level. Typical Responses: "You might get caught," "You'll go to jail," "Because mommy (God, etc.) said it's bad." My typical prod to check for a higher stage is, "What if you know you won't get caught?" or "What if you know you won't get punished?" When a student responds with guilt, "I'll feel bad inside," ask "Why?" to try to determine what stage the guilt is based upon. For stage one, for example the student might say, "Sooner or later, somebody will find out."
2. Reciprocity (economic): Ages 7 & 8. Corresponds with the first stages of concrete operations: conservation of length and number. Typical Responses: "You didn't earn it" (Prod for a higher stage). "You have to pay for it." (Prod to make sure there is the idea of fairness of exchange). "It's not fair" (Prod for a higher stage).
3. Social Reciprocity (Sympathy): Ages 9 to 11. Corresponds with middle to the higher stages of concrete operations: conservation of liquid volume and classification. Typical Responses: "They would feel bad" (Prod to make sure that it is the victim who would feel badly). "If someone

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<sup>6</sup>This adaptation of the Kohlberg Scales is based upon research versions of the Kohlberg Scales, obtained with permission and in cooperation with Lawrence Kohlberg for a research project by Steve Valdez in the mid 1970s, and based upon field application in the public schools in the ensuing years. This application was developed in the public sector and is not to be distributed for profit. Dr. Valdez requests acknowledgment in the distribution, publication or further development of this adaptation.

<sup>7</sup> Substitution of the term "Ethical Development" is suggested for use in the public school system"

<sup>8</sup> Most people rely upon what they are most sure of when under stress, that includes regression to lower levels of ethical judgment.

<sup>9</sup> For a student that is often or has recently been accused of wrong doing, take care with the timing and wording of the question about stealing. Clarify, in advance, that the student is not being accused and that the question is part of a series of questions that are asked of students during the assessment process.

<sup>10</sup> ESL and language disabled children may require extra prodding or bilingual communication to help them express their thoughts.

<sup>11</sup> Students identified as learning disabled often respond at Kohlberg levels lower than their age would typically indicate. Their ethical judgment stages also often lag behind Piagetian cognitive stages. This may have something to do with why they tend to get in more trouble at school.

stole from me, I would feel sad.” (Probe to clarify whether: based on concern for others - stage 3, based on concern for self - stage 1, or based on sense of duty - stage 4). “Your friends won’t like you anymore” (On the surface, this response sounds like stage 1, but further prodding usually reveals stage 3; ask, “Why won’t they like you anymore?” for clarification). “If they get away with it, other people will think they can steal too.” (This response is tricky to sort out. Prod to verify that the idea of a bad example is based on interpersonal conformity. If still not clear, try asking, “What if no one else finds out about it, is it wrong to steal & why?” to check for other stages).<sup>12</sup>

4. Social Rules (Systematic): Ages 12 to 14. Corresponds with early stages of formal operations, (demonstrated by very few K-8 SLD students). Typical Responses: “If everybody stole, things would be crazy.” (Probe to make sure this response has not simply been memorized, “What do you mean by “crazy”?). “It’s the law.” (Probe to make sure that the idea is based on a system of laws, “What is the law for?” Responses that include the ideas of orderliness in society or one’s contribution for the good of society are stage 4. Responses that indicate moral relativity are stage 5.) “The Bible tells us not to steal.” (Cautiously probe to make sure that this is not a stage 1 response, “What does the Bible say?” & “How does the Bible help? Responses including “rules to live by” and “God’s plan” usually indicate stage 4.) Do not stop at a response indicating punishment from God, before probing further for higher stages than stage 1, e.g. “An eye for an eye,” stage 2: “God feels sad when...” stage 3; “We choose to follow the (denomination) convention that...” stage 5.

5. Social Agreement (Democracy): Ages 14 & up. Corresponds with mature Formal Operations. Typical Responses: “People have agreed that stealing is wrong,” “Elected officials pass laws - that’s democracy,” “The rights of the individual are not more important than the rights of most of the people,” “As a society we argue about and decide what will be right and what will be wrong.” (Occurrences of stage 5 moral judgment are rare among junior high students. Probing usually indicates memorization of a social studies lesson without full comprehension).

6. Universal Principles (Philosophy of Ethics). Neopiagetian Post Formal Operations. Some philosophers, Zen masters, Kohlberg, etc., age 50. Typical Responses: Not applicable in the K-12 setting.

Reasoning with a child about their behavior is most effectively directed to their stage of ethical development or toward encouraging progress to the next higher stage.

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<sup>12</sup> Internationally, while developing on to demonstrating higher level responses, females tended to persist in giving stage 3 responses (Social Reciprocity). With girls, ages 11 and up who give stage 3 responses, probe for higher level responses.

*some time, but started doing it regularly as a result of his experience on the Larry P. Task Force.*