Application of the Allen Cognitive Level Test in Assessing Cognitive Level Functioning of Emotionally Disturbed Boys

Marsha E. Shapiro

Key Words: cognition • learning • tests, by title, Allen Cognitive Level Test

The purpose of this study was to ascertain the applicability of the Allen Cognitive Level Test (ACL) (Allen, 1982, 1985), developed for use with adult psychiatric patients, to emotionally disturbed children aged 8 to 15 years. The subjects' performance on the ACL was compared with their performance on two other instruments that measure features of cognition: the Developmental Test of Visual-Motor Integration (VMI) (Beery & Buktenica, 1982) and the Perceptual Memory Task (McCarron, 1984). Pearson product-moment correlations were computed to study the relationships of the ACL, the Perceptual Memory Task full-scale and subscale scores, and the VMI raw and age-equivalent scores. The Perceptual Memory Task scores showed little or no correlation with the ACL scores. Correlations of the ACL with the VMI scores revealed moderate but significant coefficients. A relationship between age and ACL score was found. Preliminary data would indicate that the ability of emotionally disturbed children to function in the school environment depends on their mastery of task demands and that occupational therapy intervention cannot be based solely on age or level of intelligence.

A fundamental task of the school-based occupational therapist working with the emotionally disturbed child is to assess the child's behavior and abilities in the performance of daily activities. The purpose of this assessment is to enhance the child's educational program. This is accomplished through consultation with teachers and with other service providers and through direct occupational therapy intervention. Suggestions for activities and environmental organization in both the therapy and classroom settings are based on the child's age, developmental level, and environmental demands. The child in the occupational role of student is expected to functionally demonstrate the ability to learn and retain new information while conforming to society's perceptions of normal, age-appropriate behaviors.

This study explores the possibility of assessing the emotionally disturbed child's current cognitive level of functioning, with the expectation that such an assessment would help pinpoint the child's ability to process new information related to both academic and social learning. Allen (1985) defined a cognitive disability as "a series of functional units of behavior that cut across diagnostic categories and interfere with task behavior" (p. 732). With this information, the therapist could recommend modifications in the school and therapy settings to enable the child to function more successfully. Furthermore, periodic reassessment of cognitive functioning would enable the therapist to provide input to the teacher regarding any change in functioning over the course of the school year.

Occupational Therapy

The ability to learn new information is a lifelong requirement for the successful fulfillment of occupational roles (Kielhofner, 1985; Matsutsuyu, 1973; Reed, 1984). For children to learn, they must be aware of the environment, attend to specific stimuli in the environment, respond to environmental stimulations, and order their responses to the environment in a meaningful or productive way (Shea, 1978). This list of prerequisites is similar to the view of cognition developed by Allen. In addition, McCarron (1984) noted that "perceptual memory skills are essential underlying processes for learning and academic achievement. Therefore, a valid measure of memory skills would be significantly and consistently related to various measures of academic achievement" (p. 49). Allen (1985) took the definition of cognition further and described a behavioral hierarchy for various degrees of mental impairment. Of benefit to the educational setting is her description of the sensory and environmental cues that characterize the learning environment. She has included guidelines for the analysis and adaptation of tasks and task environment for each cognitive level.

Allen (Allen, 1982, 1985; Allen & Allen, 1987) has documented six levels of cognitive functioning in adult
Emotionally Disturbed Children

It has been noted clinically and in the literature (Weininger, 1979–1980) that many emotionally disturbed children do not see things presented to them.

Emotionally disturbed children treated in a medical setting (e.g., in an acute care psychiatric hospital) are usually given a diagnosis from the Diagnostic and Statistical Manual of Mental Disorders (3rd ed., rev.) (American Psychiatric Association, 1987), medication, psychotherapy, and referral for occupational therapy evaluation and treatment (Sarason & Sarason, 1984; Tiffany, 1983). The occupational therapy intervention in the medical milieu is generally directed at observable behaviors, which may consist of any of the following: (a) physical or verbal aggression, (b) disruptive behaviors (e.g., speaking out of turn, making noises), (c) extreme shyness, (d) withdrawal, (e) chronic somatic complaints without any evidence of physical origin, (f) depression (Shea, 1978).

In the educational setting, children who exhibit the above symptoms and behaviors are often classified as emotionally disturbed. According to the State Education Department (1984) of New York State, the emotionally disturbed pupil has "an inability to learn which cannot be explained by intellectual, sensory or health factors . . . over a long period of time and to a marked degree" (p. 4). The educational classification is an attempt to classify children on the basis of functional ability rather than on the basis of symptomatology. The level of functional capacity is measured by classroom performance, which is generally low for this population. This is believed by some researchers to be due to the reciprocity of cognition and affect during development: Strengths and weaknesses in one domain are viewed as strengths and weaknesses in the other (Brooks, 1984).

Contributions of Occupational Therapy Intervention With Emotionally Disturbed Children

When the emotionally disturbed child is referred for school-based occupational therapy, the therapeutic goals must reflect and augment the educational goals mandated by the student's individualized education program. In this setting, behavioral problems may be seen as secondary to the neurological problems often displayed by these children. Many students classified as emotionally disturbed are learning disabled as well. Often, the classification of emotionally disturbed may have been preceded in previous years by the classification of learning disabled (Shea, 1978; Stephens, 1977).

When treating the emotionally disturbed child, the school-based occupational therapist often focuses on facilitating the acquisition and enhancement of the student's fine and gross motor skills as well as his or her sensorimotor and perceptual-motor abilities as they relate to classroom performance. For the occupational therapist, however, two questions come to mind in both the medical and educational settings:

1. How can the environment be structured to facilitate the learning necessary to achieve treatment goals in the hospital or educational goals in the classroom?
2. What type of standardized and measurable information can be provided to the medical or educational team regarding the functional abilities and deficits of the child?

These same questions have been raised by occupational therapists working with adult psychiatric patients. In acute care settings, where most psychiatric patients are treated by occupational therapists, the notion of changing behaviors during the typical 15-day length of stay has challenged therapists to reassess their roles (Allen, 1982).

Some programs for emotionally disturbed children focus on behavior more than on academic accomplishment, whereas others view academic goals as primary (Shea, 1978). Parents, teachers, psychologists, and other caregivers struggle with questions regarding environmental structure and demands. A tool such as the ACL could offer a systematic approach to occupational therapists.
assessing students' functional abilities and their environmental requirements for learning academic and social rules and skills. With this information, the teacher and the occupational therapist could then structure the school and therapy settings to enable the child to function more successfully in the student role.

The purpose of this study was to ascertain the applicability of the ACL for emotionally disturbed children aged 8 to 15 years. The subjects' performance on the ACL was compared with their performance on two other instruments that measure features of cognition: the Developmental Test of Visual-Motor Integration (VMI) (Beery & Buktenica, 1982), which measures visuomotor integration, and the Perceptual Memory Task (McCarron, 1984), which measures perceptual memory skills in the areas of conception, vision, audition, recognition, and sequencing. If associated, the VMI and the Perceptual Memory Task could add to the construct validity of the ACL. All these behaviors require the integration of many neurological processes. No one instrument can simultaneously tap into all of these processes and measure them as discrete entities, nor would this be particularly useful, because neurological function is based on the interaction of processes (Brooks, 1984).

Method

Subjects

Initially, the sample was the entire student body of a private school (N = 30) in western New York State. However, parental consent for participation in the study was obtained only for 25 students, and 1 subject was unwilling to participate, thus leaving a total of 24 subjects. The subjects, all male, ranged in age from 8 years 4 months to 15 years 9 months, with a mean age of 12 years 5 months. Each had been classified as emotionally disturbed by his home school district's committee on special education. In addition, each had been designated for placement in a self-contained classroom consisting of a maximum of six students, one teacher, and one teacher's aide.

Instrumentation

The Perceptual Memory Task: This assessment was used to measure perceptual memory skills, the "essential underlying processes for learning and academic achievement" (McCarron, 1984, p. 49).

Task performance on the Perceptual Memory Task involves both visual and auditory input but requires only visuomotor output. The Perceptual Memory Task consists of four subtasks: spatial relations, visual designs, auditory-visual colors, and discrimination recall.

The spatial relations subtask yields one score. The visual design subtask yields two scores, recognition and sequence, which are summed. Similarly, the auditory-visual colors subtask yields recognition and sequence scores, which are summed. The discrimination recall subtask yields one score. The total Perceptual Memory Task score is the sum of these six scores.

The spatial relations subtask is a block construction activity. The subject is presented a series of 13 block designs in order of increasing complexity. The designs consist of 3 to 9 blocks. Ten blocks are provided. A design card is presented for 10 sec and is then removed, at which point the subject is asked to reconstruct the design. One point is scored for each block in the correct position. If the subject is unable to successfully complete a design, the card is shown and instruction for correct completion is provided by the tester. After each trial, the blocks are disassembled so that they are ready for the next trial.

In the visual design subtask, 12 cards, each with a series of 1 to 6 design patterns, are presented to the subject for 10 sec. On a tray in front of the subject are 12 blocks, each with a different multicolored design. When the design card is removed from view, the subject must choose the design sequence presented from the blocks on the tray and place these blocks on a rack.

The auditory-visual colors subtask requires the subject to remember a series of colors, as read by the tester. Each of the 12 trials in this section consists of a series of 1 to 7 colors. Again, the subject has a tray with 12 blocks before him; each block is one of 12 colors.

The discrimination recall subtask consists of two recall activities. The first requires the subject to sort 26 spatial construction cards—13 of the original block design cards plus 13 block designs not previously seen. These are the distracter cards. The subject is asked to pick out the block cards previously used. One point is scored for each design correctly chosen, and 1 point is subtracted for each incorrect choice. The second recall activity requires the subject to sort 24 design-pattern cards, half of which were the ones seen during a previous subtask. The score is based on the number of designs incorrectly identified subtracted from the number correct.

The Perceptual Memory Task was standardized and field-tested on normal children and diverse groups of developmentally disabled persons, including those with learning and psychiatric disabilities (McCarron, 1984). The age-related tables of norms are based on normal developmental data (n > 1,500; range = 4 to 35 years) (McCarron, 1984).

The correlation for test-retest reliability of the Perceptual Memory Task has been reported as .91 for 150 nondysfunctional children and .93 for 51 neuropsychologically disabled adults (McCarron, 1984). According to McCarron, "approximately 83% and 87% of the variance for the respective groups can be accounted for by perceptual memory skills" (p. 34). The correlation for split-half reliability has been reported as .89 for nondysfunctional children aged 4 to 6 years and .91 and .92 for nondysfunc-
Table 1
Correlation of Subjects' Scores on Three Tests of Cognitive Functioning (N = 24)

<table>
<thead>
<tr>
<th>Assessment</th>
<th>ACL Score</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptual Memory Task&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.11</td>
<td>.30</td>
</tr>
<tr>
<td>Constructional factor</td>
<td>.18</td>
<td>.20</td>
</tr>
<tr>
<td>Visual factor</td>
<td>-.04</td>
<td>.42</td>
</tr>
<tr>
<td>Auditory factor</td>
<td>.16</td>
<td>.23</td>
</tr>
<tr>
<td>Recognition factor</td>
<td>.19</td>
<td>.19</td>
</tr>
<tr>
<td>Sequencing factor</td>
<td>-.04</td>
<td>.42</td>
</tr>
<tr>
<td>Test of Visual-Motor Integration&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Raw score</td>
<td>.42</td>
</tr>
<tr>
<td></td>
<td>Age-equivalent score</td>
<td>.36</td>
</tr>
</tbody>
</table>


I examined the concurrent validity of the Perceptual Memory Task by determining the association between subjects' Perceptual Memory Task performance and teachers' ratings of students' memory functioning, which yielded a correlation of .69 (p < .0001) (McCarron, 1984).

The Developmental Test of Visual-Motor Integration (VMI). The VMI measures visuomotor integration in children aged 2 to 15 years for the purpose of designing appropriate educational programming and not for a diagnosis (DeGangi, 1987). When used with children past kindergarten age, it is designed to screen for those who have neurological impairments or learning disabilities or both (DeGangi, 1987).

The VMI consists of 24 geometric forms that the subject is to copy exactly. The forms are presented in order of increasing complexity, three on each page. For example, the first page contains a vertical line, a horizontal line, and a circle, whereas the last page consists of complex forms, including 2 three-dimensional figures. Scores for the VMI are presented both as standard scores and as age-equivalent scores for children aged 2 to 15 years.

DeGangi (1987) stated that "visual perception and motor functions are not necessarily predictive of visuomotor integrative functioning. Problems in visual-motor functions may be a result of either dysfunction in visual perception or an interaction of the visual and motor systems" (p. 147).

Interrater reliability coefficients obtained on 120 subjects ranged from .93 to .98 among psychologists, resource teachers, and classroom teachers (DeGangi, 1987). Test-retest reliability ranged from .63 for a 7-month period between testings to .92 for a 2-week period between testings. Split-half reliability coefficients ranged from .66 to .93, with a median of .79 (DeGangi, 1987).

Procedure
The ACL, the Perceptual Memory Task, and the VMI were administered individually to all subjects. To minimize test administrator bias, the ACL was administered first. A subject's ACL score was compared with his scores on the Perceptual Memory Task and the VMI with the use of Pearson correlation coefficients.

Results
The ACL scores ranged from 2.9 to 6.6 (M = 5.1; SD = .8). Pearson correlation coefficients were computed to study the relationships of the ACL scores, the Perceptual Memory Task full-scale and subscale scores, and the VMI raw and age-equivalent scores (see Table 1).

Correlation of the full-scale Perceptual Memory Task with the ACL was not statistically significant. Subscale Perceptual Memory Task scores also showed little or no correlation with the ACL scores (the range was from r = -.04, p = .42 to r = .19, p = .19). Correlations of the ACL with the VMI revealed moderate but significant coefficients for raw and age-equivalent scores.

The availability of IQ scores for most of the subjects (23 students had full-scale scores; 19, verbal scale scores; 18, performance scale scores) as well as the disappointing relationship between the ACL and the Perceptual Memory Task scores led to the decision to examine the relationships of IQ to the ACL scores (see Table 2).

The relationship the subjects' age to ACL score revealed a moderate correlation (.43). However, due to the small number of subjects at any one age, the statistical significance of this relationship is not clear.

In a final data check, the correlation of previous leather lacing experience with ACL scores was examined to see what effect, if any, such experience had on

Table 2
Correlation of Subjects' Test Scores With Age, IQ, and Lacing Experience

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Age</th>
<th>p</th>
<th>Visual IQ Score</th>
<th>p</th>
<th>Performance IQ Score</th>
<th>p</th>
<th>Full-Scale IQ Score</th>
<th>p</th>
<th>Leather-Lacing Experience</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen Cognitive Level Test&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.43 (n = 24)</td>
<td>.02</td>
<td>.21 (n = 19)</td>
<td>.20</td>
<td>.56 (n = 18)</td>
<td>.01</td>
<td>.11 (n = 23)</td>
<td>.31</td>
<td>.19 (n = 24)</td>
<td>.19</td>
</tr>
<tr>
<td>Perceptual Memory Task&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-.15</td>
<td>.24</td>
<td>.53</td>
<td>.01</td>
<td>.52</td>
<td>.01</td>
<td>.56</td>
<td>.005</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Test of Visual-Motor Integration&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Raw score</td>
<td>.37</td>
<td>.04</td>
<td>.20</td>
<td>.20</td>
<td>.44</td>
<td>.04</td>
<td>.33</td>
<td>.06</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Age-equivalent score</td>
<td>.35</td>
<td>.05</td>
<td>.23</td>
<td>17</td>
<td>.47</td>
<td>.03</td>
<td>.36</td>
<td>.05</td>
<td>-</td>
</tr>
</tbody>
</table>

ACL performance. The small, nonsignificant correlation ($r = .19, p = .39$) suggested that prior lacing experience had little effect on ACL scores.

**Discussion**

The hypothesis that students' scores on measurements of components of cognition (including perceptual memory and visuomotor integration skills) would show a positive relationship with their scores on the ACL was partially confirmed. The significant correlation of the ACL scores with the raw score of the VMI suggests that the ACL may partially measure visuomotor integration. Because the Perceptual Memory Task scores correlated significantly with both verbal and performance IQ scores, it may measure cognitive domains more closely associated with IQ scales than those associated with the ACL. The ACL may also measure cognitive performance ability independent of perceptual memory ability as measured by the Perceptual Memory Task.

Although I assumed that learning the leather lacing tasks of the ACL required abilities measured by the Perceptual Memory Task either in whole or in part, the low correlations between the two instruments suggested otherwise. Perhaps a better measure of cognitive levels of children can be found in the performance of routine tasks, a notion put forth by Allen (1985) in her study of adults. To investigate this possibility, an instrument such as the Functional Independent Measure (Granger et al., 1987) would need to be compared with ACL performance. The Functional Independent Measure is a normed instrument that assesses independent routine functioning in persons aged 7 years and up in the areas of self-care, sphincter management, mobility, locomotion, communication, and social cognition.

**Relationship to Previous Studies**

The finding that subjects' ACL scores correlated significantly with their performance IQ scores supports Mayer's (1988) finding with adult psychiatric inpatients (aged 17 to 79 years, $M = 33$ years). This positive relationship suggests that the ACL taps some of the same components as intelligence tests. In addition, the significant correlation of the ACL scores with performance IQ suggests that the ACL may be a valid test for use in differentiating cognitive level functioning for emotionally disturbed boys aged 8 to 15 years.

The finding of a nonsignificant correlation between ACL scores and verbal IQ contrasts with Mayer's (1988) findings in the adult psychiatric population. Because crystallized abilities are reflected in verbal scale scores and "are dependent on previous training, education, and acculturation" (p. 176) and because these abilities are still developing during childhood, one would not expect verbal scale IQ scores to correlate with the ACL scores in children. These inconsistencies between the present study and Mayer's study call for a closer examination of the relationship between ACL and IQ scores.

The correlations between the performance and verbal scale IQ scores and ACL scores in the present study, however, were consistent with the idea that fluid abilities and crystallized abilities are correlated components of general adaptive ability (Mayer, 1988). This is because fluid abilities, reflected more in performance scale scores, are "perceptual-integrative skills, which subsume information processing functions such as attention, perception, flexibility, and problem solving" (p. 176).

The finding of a positive correlation between subjects' age and ACL scores differs from Allen's (1985) study of adult subjects with dementia, where age was not found to be a factor in ACL test performance.

**Application to Intervention**

Unlike the VMI or Perceptual Memory Task, the ACL offers one the opportunity to observe subjects learning new skills and information and to observe their resulting behaviors. The differences in behaviors observed during the ACL may have been due to the fact that the ACL appeared to the subjects to be a craft activity, whereas the Perceptual Memory Task and the VMI were recognized as tests. Although the activities of this study were explained in a detailed, concrete manner, most of the subjects viewed the ACL as a lesson in learning leather crafting. Therefore, the subjects may have viewed it as something to be enjoyed rather than as a threatening or judgmental task. The subjects were more relaxed and interacted more with the examiner during this test than during the other two tests, revealing more spontaneous behaviors. These behaviors included many coping, adapting, and social interaction features, such as asking questions, recalling similar experiences, expressing and demonstrating motivation, revealing problem-solving approaches and methods of dealing with frustration and success, recognizing errors, and attempting to manipulate the examiner. Several subjects expressed disappointment that the ACL did not culminate with a finished product. Others insisted that other lessons in leather crafting were to follow during the school year. None of the subjects indicated a desire for tasks of the VMI or Perceptual Memory Task to continue beyond the assessment.

Scores on the ACL may have been enhanced by the fact that participation was voluntary. For emotionally disturbed children, issues of control may become the focus of whether to comply when faced with task performance. When the decision to comply was left to the subjects' discretion, their focus shifted from engagement in a power struggle with an adult to the task demands of the ACL. Therefore, one may argue that the ACL, as used in this study, is not an accurate reflection of task demands in a classroom setting. However, considering the fact that vol-
Voluntary participation was 95% (i.e., 24 of the original subjects), use of this test as an optional component to emotionally disturbed children may be a useful strategy for the assessment of cognitive function. If one considers the behaviors observed to be performance based on optimal conditions for task compliance, a judgment then can be made as to a subject's true cognitive abilities when the behavioral issues of control are removed. One way to test for the effect of mandatory versus voluntary participation is to evaluate test performance in two different test conditions. I would hypothesize that the difference would not be statistically significant. What may turn out to be significant, however, are the task behaviors noted above. Although not scored during task performance, these behaviors provide anecdotal information about overall functional skills. The ACL appeared to serve well as a standardized, criterion-referenced clinical instrument to elicit and observe task performance behaviors.

Of particular note throughout the entire test administration was the change in attitude displayed by many of the subjects when they realized that participation was totally voluntary. Often expect to be told they had to cooperate with test protocol, subjects would initiate disruptive behaviors such as talking when directions were being given, standing up to walk around, and being generally inattentive. When informed that their presence was voluntary and that they could return to their classrooms at any time, all but 1 subject elected to remain in the study and to be fully cooperative. Some subjects needed to be reminded of their voluntary participation more than once throughout the study, but they always chose to remain. These observations were also suggestive of further avenues of research pertaining to choice, test behavior, and test performance.

Study Limitations

Interpretations of the results must be made with caution. Because a nonrandom convenience sample was used, it was not representative in terms of age and sex of the full range of emotionally disturbed children encountered by the school-based occupational therapist. However, in terms of behavior and level of functioning, the sample was thought to be typical of the range of emotionally disturbed children encountered within the school setting. Other limitations include the geographic homogeneity and small sample size.

Future Research

Based on moderate correlations with the VMI and performance scale measures of intelligence, the ACL shows promise as a tool for assessing the cognitive levels of emotionally disturbed children. However, the findings of this study raised new research questions. Is age a significant factor in ACL performance? Studies of larger samples of children of various ages and of normal children are needed to test the relationship between age and ACL performance. Is the ACL sensitive to other populations of children? The children in this study were classified by their school districts as functioning at about the same level of needed supervision and structure. Other groups to study would be males and females of various ages and levels of functioning; acute psychiatric pediatric inpatients; nondysfunctional children; and learning-disabled children without emotional or behavioral problems.

The variations in ACL scores suggest that occupational therapists must continue to emphasize environmental and contextual aspects of task performance when working with emotionally disturbed children, for their ability to function in the school environment depends on their mastery of task demands. Because the older children in this study did not consistently perform better than the younger children, nor did the children with higher IQ scores consistently perform better than those with lower IQ scores, occupational therapy intervention cannot be based solely on age or level of intelligence.

Acknowledgment

I thank Roger Fiedler, Ph.D., for constructive support and guidance throughout the statistical analysis and organizational process of this study.

References


