

Analysis of Modes of Performance for the Hierarchies of Functional Cognition and Cognitive Activity Demands in the Allen Cognitive Scale

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Background: The *Allen Cognitive Scale of Levels and Modes of Performance (Allen Cognitive Scale)* describes the progression of increasing or decreasing *complexity* of persons' *functional cognitive capacity* that can be inferred based on observation of persons as they perform routine (everyday) activities.^{1,2,3,4,5} *Cognitive complexity* refers to how complicated various cognitive function/processes, functional performance abilities, and activity demands are.^{3,4,5} Although the Allen Cognitive Scale is a single scale, it can be used to estimate both the cognitive complexity of *functional cognitive capacities* of people and the cognitive complexity of *activity demands* for activities people need and want to do. For this reason, it is best understood as consisting of two interrelated, parallel hierarchies.

- The ***Hierarchy of Functional Cognition*** describes the inferred continuum of increasing complexity of *functional cognitive capacity* and *functional performance abilities* such as observations of the sensory cues that capture a person's attention, the person's voluntary actions, use of objects, sequencing and timing, and verbal/non-verbal and social behaviors for engaging in everyday activities that are theoretically available at each level/mode.
- The ***Hierarchy of Cognitive Activity Demands*** describes the continuum of increasing cognitive complexity of the *components or aspects of activities* that are typically required for their performance, such as relevance, objects used and their properties, actions and performance skills, social behaviors, steps and processes, and space and time requirements. These components are collectively referred to as the activity demands.^{3,4,5}

Practitioners who use the CDM to guide evaluation and intervention with clients with cognitive disabilities focus on *creating a fit* among the person's functional cognitive capacity, physical capacities, other relevant person and contextual factors and the activity demands of the activities the person needs and wants to do.^{3,4,5}

The following activity analysis in Table 1 may be used by practitioners in the evaluation and intervention process to:

- interpret observations of performance and data collected from others to verify and interpret ACL Screen scores,
- analyze the cognitive complexity of activities a person needs and wants to do,
- identify task equivalence of new activities and occupations for realistic goal setting, and
- create a *fit* between the person's cognitive capacities and meaningful everyday activities in supportive environments to support successful intervention outcomes.

References

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- ³McCraith, D. B, Austin, S. L., & Earhart, C.A. (2011). The cognitive disabilities model in 2011. In N. Katz (Ed.), *Cognition, occupation, and participation across the lifespan: Neuroscience, neurorehabilitation, and models of intervention in occupational therapy* (3rd ed., pp. 383-406). AOTA Press.
- ⁴McCraith, D. B, & Earhart, C.A. (2018). Cognitive Disabilities Model: Creating fit between functional cognitive abilities and cognitive activity demands. In N. Katz and J. Togli (Eds.), *Cognition, occupation, and participation across the lifespan: Neuroscience, neurorehabilitation, and models of intervention in occupational therapy* (4th ed., pp. 469-497). AOTA Press.
- ⁵Earhart, C.A., McCraith, D.B, & Riska-Williams, L. (2022). *Manual for Version 5 of the Allen Cognitive Level Screen* (2nd ed.). ACLS and LACLS Committee/Allen Cognitive Group.

Table 1: Analysis of Modes of Performance for the Hierarchies of Functional Cognition and Cognitive Activity Demands in the Allen Cognitive Scale

Allen Cognitive Level/Mode	Hierarchy of Functional Cognition		Hierarchy of Cognitive Activity Demands (Observed)
	Abilities Available for Use (Inferred)	Patterns of Performance: Typical Motor, Verbal, and Social Behaviors (Observed)	
1.0 Withdrawing from noxious stimuli	<ul style="list-style-type: none"> Recognizing & responding to internal sensory stimulus Recognizing & responding to noxious external stimulus 	<ul style="list-style-type: none"> Withdraws whole body from a noxious cue Makes inborn non-verbal utterances: grunts, moans Very slow response 	<ul style="list-style-type: none"> Wet cloth Pinprick, ice cube Flashlight Loud noise
1.2 Responding to stimuli in one sensory system	<ul style="list-style-type: none"> Moving eye, nose, mouth Recognizing & responding to a sensory stimulus in front, within 14" of face Moving head toward or away from a stimulus 	<ul style="list-style-type: none"> Moves eyes, nose, mouth Opens/shuts eyes Opens/shuts mouth/smiles Selective, non-verbal utterance in response to stimulus Turns head towards/away from stimulus Very slow response ≥ 20 seconds 	<ul style="list-style-type: none"> Sharp smells, tastes Alerting sounds: buzzer, bell, Human face, voice Deep pressure, touch to face
1.4 Locating stimuli	<ul style="list-style-type: none"> Moving head on neck Recognizing & turning head toward the location of stimuli Following moving sensory stimuli by turning head Anticipating being fed & opening mouth Swallowing Recognizing repeated stimuli 	<ul style="list-style-type: none"> Rotates head, eyes, neck Swallows when food is placed in mouth Tracks moving objects within 14" Anticipates cue (feeding) Non-verbal expressions: pleasure, disgust Heightened response to repeated stimuli Maintains attention to stimuli for seconds Very slow responses 	<ul style="list-style-type: none"> Being fed by others Moving colors & objects Guided hand to mouth movement
1.6 Rolling body in bed	<ul style="list-style-type: none"> Moving trunk & limbs in bed Recognizing location of discomfort from pressure on body part Recognizing & responding to varied textures of food in mouth 	<ul style="list-style-type: none"> Moves trunk, legs, arms in bed, very slow Moves to relieve pressure Changes oral movements based on texture Non-verbal expressions, cries out Maintains attention for a few seconds 	<ul style="list-style-type: none"> Pressure on trunk, limbs & bone Food texture (fluid, thick) Continuous verbal and tactile cues to hold position of limbs & trunk

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1.8 Raising body part	<ul style="list-style-type: none"> • Moving through range of motion in upper extremities • Recognizing & grasping food in 14" • Feeding self with finger food • Protecting self by hitting and kicking in bed • Protecting self by stating "No" 	<ul style="list-style-type: none"> • Grasps finger food in 14", places in mouth • Drinks from cup placed in hand • Hits balloon/ball aimed at hand • Assists with pivot transfer • Says "No" to perceived threats • Hits, kicks to protect self • Maintains attention for several seconds • Very slow responses 	<ul style="list-style-type: none"> • Finger food • Drinking cup placed in hand • Balloon/ball aimed toward hand • Repeated taps on plate to assist locating food • Slow, demonstrated upper extremity range of motion
2.0 Overcoming gravity for sitting	<ul style="list-style-type: none"> • Maintaining upright seated position • Recognizing loved ones • Recognizing own name • Recognizing preferences • Indicating acceptance/rejection with one word • Associating count of 3 with movement 	<ul style="list-style-type: none"> • Sits in chair 20 – 30 minutes • Changes position with assist on count of 3 • Uses universal gestures (nod, clap, wave) • Says "Yes" or "No" • Heightened response to own name • Holds position until tired • Slow 	<ul style="list-style-type: none"> • Recumbent, sitting, standing positions • Chair, bed, safety belt • Loved ones, self • Preferences (food, position) • Count of 3 • Yes/No questions
2.2 Using righting reactions for standing	<ul style="list-style-type: none"> • Maintaining upright standing • Recognizing postural stability • Recognizing/naming & recognizing comfort/discomfort of body part • Recognizing location of demonstrated movement on own body 	<ul style="list-style-type: none"> • Stands up spontaneously • Stands/sits with proprioceptive cue • Extends arm to prevent falling • Imitates active range of motion in one arm • Names parts of body • Slow pace 	<ul style="list-style-type: none"> • Demonstration of active range of motion in one arm in horizontal or vertical plane • Tactile cues on body parts • Questions about body part
2.4 Walking	<ul style="list-style-type: none"> • Recognizing freedom of movement • Maintaining balance walking on flat surfaces • Recognizing obstacles to movement at eye level • Sensing confinement 	<ul style="list-style-type: none"> • Walks around barriers at eye level to knees, on flat surfaces until tired; slow • Walks where pointed to go • Rocks, marches, uses reciprocal pulleys • Uses one word to start communication 	<ul style="list-style-type: none"> • Rhythmic actions • Rocking chair, reciprocal pulleys • Barriers at eye level: walls, doors, furniture, flat walking surfaces • Gestural cues to direct walking

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2.6 Walking to a location	<ul style="list-style-type: none"> Recognizing location of freedom of movement Sensing walking along a route Recognizing destination Recognizing barriers below the knee Lifting legs to step up & over barriers Recognizing clothing on body Recognizing & singing familiar tunes 	<ul style="list-style-type: none"> Follows escort to location Steps up, down, over barriers Pushes, pulls, scoots w/cue Attempts to disrobe if uncomfortable Names destination Walks until reaches destination Sings Slow pace 	<ul style="list-style-type: none"> Route that may be repeated Barriers below knees; features of location: toilet, bed, table Objects to push, pull, throw: wheelchair, broom, ball Familiar clothing Verbal cue for typical dressing action (push, pull arm or leg) Familiar songs
2.8 Grasping for stabilizing	<ul style="list-style-type: none"> Sensing stability during movement Maintaining balance by grasping & holding onto objects Protecting self by pushing, hitting, kicking at a target Distinguishing objects by names Imitates new song 	<ul style="list-style-type: none"> Grips objects tightly Hits or kicks targets Learns songs Names persons, targets, objects Holds until stable Slow pace 	<ul style="list-style-type: none"> Stable objects to hold on to: grab bars, large furniture, other people Objects to punch or kick Pillow, ball, balloon Cues to release objects New songs
3.0 Grasping objects	<ul style="list-style-type: none"> Handling objects Recognizing/naming familiar objects Recognizing/naming familiar manual actions Distinguishing self from others 	<ul style="list-style-type: none"> Spontaneously grasps & releases objects Feels & names common objects Uses nouns & verbs; uses “I” & “you” Gives own name when asked Holds for a few seconds Slow pace 	<ul style="list-style-type: none"> Familiar, safe objects within 14 inches in front Familiar objects that may be grasped in one hand: comb, washcloth, hair brush, spoon, cup, stuffed toy
3.2 Distinguishing objects	<ul style="list-style-type: none"> Moving objects back and forth Associating familiar objects with typical grasp & action Holding objects with typical grasp 	<ul style="list-style-type: none"> Grasps familiar objects appropriately Uses objects appropriately briefly (grasps pencil & makes actions of writing) Uses short phrases Moves objects up to 1 minute, slow pace 	<ul style="list-style-type: none"> Familiar, safe objects that may be moved back and forth within reach in front Objects with various grasp patterns: comb, washcloth, pencil, cup

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3.4 Sustaining actions on objects	<ul style="list-style-type: none"> • Repeating a familiar manual action • Recognizing a line/row • Recalling/naming current actions 	<ul style="list-style-type: none"> • Repeats a familiar action with an object for several minutes • Places objects in a single row • Resumes actions when cued to continue • Names current action • 1 – 5 minutes • Slow pace 	<ul style="list-style-type: none"> • Familiar objects with actions that may be repeated within reach in front • Objects that may be placed in a row • Verbal cues to continue action
3.6 Noting effects on objects	<ul style="list-style-type: none"> • Picking up & placing objects • Recognizing immediate visible effects of actions (shape) • Moving in a direction (along a line) • Noting gender 	<ul style="list-style-type: none"> • Imitates picking up & placing objects in line • Moves object in one direction (left to right) • Stops when immediate visible effect changes • Follows a line (perimeter, people) • Persists up to 30 minutes 	<ul style="list-style-type: none"> • Familiar objects within reach, front • Perimeter, shape, line • Objects larger than ¼ inch • Processes with immediate, striking effects (apply paint, turn off light switch, hit drum) • Verbal cues to stop, continue
3.8 Using all objects	<ul style="list-style-type: none"> • Being “done” • Recognizing filling/emptying a space • Recognizing depletion of material and supplies • Continuing to act until “done” 	<ul style="list-style-type: none"> • Imitates familiar 3-action sequence • Stops when “done” when objects are depleted or space is filled • States they are “done” when objects are depleted or space is filled 	<ul style="list-style-type: none"> • Demonstrations containing 1-3 familiar actions • Groups of similar familiar objects • Objects with interior spaces, • Verbal cues to continue
4.0 Sequencing familiar actions	<ul style="list-style-type: none"> • Directing self through a familiar sequence of steps to achieve a short term goal • Recognizing obstacle to short term goal • Matching/following an internal sample • Recognizing possession of an object 	<ul style="list-style-type: none"> • Initiates familiar action sequence to complete goal when objects are present • Recognizes errors but does not correct them • Chooses to keep or not keep a project • Locates supplies in familiar visible locations • Persists until immediate goal is achieved 	<ul style="list-style-type: none"> • Familiar, valued tasks with familiar objects • Objects in reach, directly in front • Processes with predictable, safe outcomes • Projects that can be possessed • Supplies in familiar, visible locations

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4.2 Differentiating features of objects	<ul style="list-style-type: none"> • Imitating a short new action sequence • Matching features of objects one at a time • Recognizing striking errors with dichotomous words • Recognizing immediate work space as belonging to self or others • Recognizing days 	<ul style="list-style-type: none"> • Imitates short sequence with 1 new action • Compares striking features of objects, one at a time (color, number, size) • Recognizes a striking error (“it’s wrong”) • May demand immediate assistance • Requests day and time, may not retain • Works at invariant pace, 2-3 times slower than typical work pace 	<ul style="list-style-type: none"> • Demonstration of short action series with one new action • Objects with striking features that can be compared to a sample one at a time (color, number, size) • Exact samples of new projects • Demonstrated solutions to correct errors • Assigned seats and supplies • Calendars at eye level for date, verbal reminders for passage of time in time sensitive activities
4.4 Completing a goal	<ul style="list-style-type: none"> • Attending to familiar routines • Attending to visual field within 36” in front or to side • Matching an external sample by comparing pairs of features • Sharing work space with others, taking turns • Recognizing time, day, month, year 	<ul style="list-style-type: none"> • Initiates, adheres to established routines • Imitates demonstrated short series of steps • Compares pairs of features with external samples before and after completion • Identifies striking errors; corrects by reversing or undoing a familiar actions • Seeks verification for problem solving methods, imitates demonstrated new solutions • Persists up to 60 minutes • Works at invariant pace, 2 -3 times slower than typical work pace 	<ul style="list-style-type: none"> • Familiar, short term tasks with exact samples • Activities with 1-3 steps • Features of width, length, position, & number up to 5 • Processes that produce immediate tangible changes • Actions without calibration, timing, or fine motor requirements • Objects in view, within 36 inches to front or side • Shared spaces and supplies, rules • Timekeeping devices within view or pre-set alarms

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4.6 Personalizing features of objects	<ul style="list-style-type: none"> Attending to surrounding visual field (360 degrees) Attending to three dimensions of volume (height, width, & depth) Recognizing the potential to vary own actions to produce a different outcome in a familiar task Recognizing similarities of previous experience to present task Recognizing two concurrent schedules 	<ul style="list-style-type: none"> Scans work space for information, supplies Alters concrete features of objects or sequence of steps to please self Varies amounts, pressure, & duration Asks for previously used supplies/tools Comments on related past experiences Changes routine to please themselves Works at invariant, near-normal pace in familiar tasks Understands two concurrent schedules 	<ul style="list-style-type: none"> Work spaces with supplies in view Samples with features to vary (color, number, size) Features of width, length, depth, position, number up to 10 Activities with problems to solve by inexact variations in position, pressure, amount of materials Cooperative activities containing two concurrent schedules
4.8 Learning by rote memorization	<ul style="list-style-type: none"> Attending to novel activities containing multiple steps Attending to multiple striking cues within the activity environment. Attending to and following written lists, one step/item at a time Accomplishing new learning by memorizing serial novel steps 	<ul style="list-style-type: none"> Reads, follows one step in written list Locates supplies in closed storage in area Rotates objects to inspect for errors Follows schedules, noting 15 minutes Requests lists & exact demonstrations of new procedures Normal work pace in familiar tasks, slower than normal pace in novel activities Follows new procedures inflexibly 	<ul style="list-style-type: none"> Exact samples to assemble Written lists, instructions, protocols Grids, tables, 45° diagonal lines Schedules, calendars Demonstrated sequences of steps Work supplies in closed storage Demonstrated safety protocols Increased time frames for completion of novel activities
5.0 Comparing and varying actions and objects	<ul style="list-style-type: none"> Attending to the small effects of own continuously coordinated actions on objects Remembering & replicating improved effects related to coordinated actions Modulating facial expression & intonation of speech Awareness of personal rights 	<ul style="list-style-type: none"> Adjusts pressure, duration, repetition of actions within ROM with fluid movements Repeats improved effects Coordinates all body parts Stops working to talk Alters facial expression & intonation to match feelings; states personal rights Works at typical, invariant work pace 	<ul style="list-style-type: none"> Representative samples; hand tools requiring bilateral coordination 1-2 steps in written instructions Verbal explanations of written instructions Angles less than 90° 3- dimensional assembly; hand tools: hammers, levers, grippers

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5.2 Discriminating among sets of actions and objects	<ul style="list-style-type: none"> • Attending to small effects of actions on surface properties of objects • Remembering & replicating improved effects on surface properties of objects • Forming categories of objects by function • Recognizing details of objects • Shifting attention between verbal and motor actions 	<ul style="list-style-type: none"> • Improves surface properties: removes contamination, dries wet surfaces, smooths rough edges, mixes materials to achieve consistency • Repeats improved effects • Groups objects by function • Uses specialized tools correctly • Consults the clock • Talks and works simultaneously • Works at normal, invariant work pace 	<ul style="list-style-type: none"> • Representative samples with surface properties to vary (sheen, wet/dry) • Simple written instructions • Complex shapes • Tints & shades of color • Groups of dissimilar objects • Memory aids
5.4 Self-directing learning	<ul style="list-style-type: none"> • Attending to the small effects of actions on spatial properties of objects • Remembering & replicating improved effects on spatial properties of objects • Adjusting fine motor actions • Adjusting pace briefly to external demand 	<ul style="list-style-type: none"> • Uses fine motor actions to improve effects on spatial properties: width, length, depth, figure/ground • Repeats improved effects • Assembles small parts within small spaces • Adjusts work space (rearranges materials, moves location for improved efficiency) • Observes severe warnings for undesirable outcomes • Questions need to alter social interactions with others • Alters work pace briefly in response to external demand but does not sustain 	<ul style="list-style-type: none"> • Representative samples with multiple parts to assemble • Simple written instructions • Small parts, details, & spaces ≤ 1/16" • Figure ground designs • Procedures requiring fine motor actions in small spaces • Modifiable work spaces • Explanations of precautions as severe warnings

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5.6 Considering social standards	<ul style="list-style-type: none"> • Anticipating secondary effects of actions on surface properties of objects • Estimating time requirements • Awareness of passage of time • Altering work pace to meet time constraint • Expressing kinship and empathy 	<ul style="list-style-type: none"> • Reads all directions & gathers supplies before starting to work • Preheats oven & iron, reads new laundering instructions, ensures ventilation for toxic vapors • Follows standard safety precautions and protocols • Expresses kinship bonds with loved ones • Expresses sympathy with strangers • Maintains track of time in seconds • Estimates time required for activities • Alters work pace to fit own estimated time requirement 	<ul style="list-style-type: none"> • Pictures and diagrams of standard outcomes • Written instructions • Time allotments • Supplies in multiple locations out of view • Activities requiring timing (cooking, laundry, ironing, mixing chemicals) • Explanations of standard safety precautions (flammables, toxins, contaminants, allergens, sharp tools)
5.8 Consulting with others	<ul style="list-style-type: none"> • Anticipating secondary effects of actions on spatial properties of objects • Recognizing potential sources of expertise and knowledge possessed by others • Comparing identified courses of possible action • Comparing potential consequences of possible social interactions 	<ul style="list-style-type: none"> • Creates new patterns and designs • Anticipates secondary effects on spatial properties (moving glued parts before dry) • Pauses to think before acting • Compares 2 identified courses of action • Asks questions to verify inferences drawn from reading directions • Seeks information from others with specialized knowledge • Shows tact in expressing opinions • Alters work pace flexibly in consultation with others 	<ul style="list-style-type: none"> • Exploded diagrams • Projects requiring developing patterns or procedures • Written explanations of potential secondary effects • Verbal directions related to spatial properties & end results • Available consultants and resources
6.0 Planned actions	<ul style="list-style-type: none"> • Considering all relevant information in goal setting/planning • Anticipating and avoiding negative outcomes in new situations 	<ul style="list-style-type: none"> • Makes deductions, inferences, hypotheses • Reflects, analyzes, self-corrects performance to improve outcomes • Pauses to think, exhibits original thought 	<ul style="list-style-type: none"> • Symbolic & abstract cues: statistics, analogies, conceptual models • Theories, belief systems, social relativism, logic, ethics