

Testing and Validating Hypotheses using the ICEL/RIOT Matrix

During the 4-Step Problem Solving Process, teams use data to generate problem statements and hypotheses to discern root causes. One tool that can assist schools in their quest to sample information from a broad range of sources and to investigate all likely explanations for academic or behavioral problems is the ICEL/RIOT matrix. This matrix helps schools to work efficiently and quickly to decide what relevant information to collect on academic performance and behavior—and also how to organize that information to identify probable reasons why the student groups are not experiencing academic or behavioral success.

The ICEL/RIOT matrix is not itself a data collection instrument. Instead, it is an organizing framework that increases schools' confidence both in the quality of the data that they collect and the findings that emerge from the data. The leftmost vertical column of the ICEL/RIOT table includes four key domains of learning to be assessed: **Instruction**, **Curriculum**, **Environment**, and **Learner** (ICEL). A common mistake that schools often make is to assume that student learning problems exist primarily in the learner and to underestimate the degree to which teacher instructional strategies, curriculum demands, and environmental influences impact the learner's academic performance. The ICEL elements ensure that a full range of relevant explanations for student problems are examined.

The top horizontal row of the ICEL/RIOT table includes four potential sources of student information: **Review**, **Interview**, **Observation**, and **Test** (RIOT). Schools should attempt to collect information from a range of sources to control for potential bias from any one source.

The power of the ICEL/RIOT matrix lies in its use as a cognitive strategy, one that helps educators to verify that they have asked the right questions and sampled from a sufficiently broad range of data sources to increase the probability that they will correctly understand the student's presenting concern(s). Viewed in this way, the matrix is not a rigid approach but rather serves as a flexible framework for exploratory problem-solving.

Adapted from http://www.inghamisd.org/downloads/iisd_se_supportservices/problem_solving_facilitator_guide_11-12.pdf and <http://ncspaonline.com/files/conference2012/cusumano-problemsolving/Hypotheses%20and%20Possible%20Targeted%20Strategies%20during%20Problem%20Solving.pdf>

Key Domains of Learning		
I	Instruction	Instruction is how the curriculum is taught.
C	Curriculum	Curriculum refers to what is taught.
E	Environment	The environment is where the instruction takes place.
L	Learner	The learner is who is being taught.

Potential Sources of Information	
R	Review of historical records and products
I	Interviews of key stakeholders
O	Observe performance in real time functional settings
T	Test through careful use of appropriately matched measurement technologies

Domain	Variables	Review	Interview	Observe	Test
--------	-----------	--------	-----------	---------	------

Testing and Validating Hypotheses using the ICEL/RIOT Matrix

Domain	Variables	Review	Interview	Observe	Test
<p style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 2em; font-weight: bold; background-color: #f08080; padding: 10px;">Instruction</p> <p>Instruction is how curriculum is taught. How content is presented to students can vary in many different ways: Level of Instruction Rate of Instruction Presentation of Instruction</p> <p>Is the curriculum being differentiated to meet the needs of the learners?</p> <p>Consider:</p> <ul style="list-style-type: none"> • instructional techniques • presentation style • clarity of instruction • questioning • feedback technique • cooperative learning • use of graphic organizers • instructional conversations • development of academic language/ vocabulary 	<p>Group/System</p> <ul style="list-style-type: none"> • Instructional decision making regarding selection and use of materials • Use of progress monitoring • Explicit Instruction • Differentiated Instruction • Sequencing of lesson designs to promote success • Use of a variety of practice and application activities • Pace and presentation of new content • Block of time allotted per subject <p>Individual</p> <ul style="list-style-type: none"> • Instructional decision making regarding placement of the student • in groups • Use of progress monitoring • Communication of expectations and criteria for success • Differentiated Instruction • Direct instruction with explanations and cues • Use of a variety of practice and application activities • Pace and presentation of new content 	<ul style="list-style-type: none"> • Unit/Lessons Plans • Permanent products (e.g. written pieces, worksheets, projects) for skill/degree of difficulty requirements • Benchmarks / standards • Assignments (calculate % of assign turned in, average amount-% of assignments completed), • Length/time required to complete assignments 	<p>Stakeholders about:</p> <ul style="list-style-type: none"> • Effective teaching practices • Instructional decision making regarding choice of materials, placement of students, instructional strategies • Sequencing/pacing of instruction • Choice of screening, diagnostic and formative assessments • Product methods (e.g. dictation, oral retell, paper pencil, projects) • Grouping structures used • Accommodations/ modifications used • Reinforcement management/ engagement strategies • Allowable repetition for mastery/ understanding • Who is providing the supplemental/ intensive instruction • Use of supportive technology • Student/group performance compared to peers • Patterns of performance errors/ behavior • Setting(s) where behavior is problematic • Significance of academic, speech, social, task or motor difficulties • Onset and duration of problem • Consistency from day to day, subject to subject • Interference with personal, interpersonal, and academic adjustment • Performance using different modes of expression (e.g. verbal, written, kinesthetic) • Teacher perceptions/hypotheses regarding why the student is unable to demonstrate the desired behaviors-academic and/or behavioral • Philosophical orientation of curriculum (e.g. whole language, phonics) • Expectations of district for pacing/coverage of curriculum 	<ul style="list-style-type: none"> • Teachers’ instructional styles/preferred styles of presenting • Clarity of instructions/ directions • Effective teaching practices • Communication of benchmarks/expectations and criteria for success • How new information is presented • Percent of time with direct instruction, whole group instruction, practice time, differentiated instruction, etc. • How teachers gain/ maintain student attention • Academic engaged time • Transitions • Large group instruction • Small group instruction • Independent work time • Group work time • Teachers use of positive reinforcement, student-teacher interaction quality/quantity, (use of direct observation protocols) • Time on task • External supports necessary to sustain engagement 	<p>Classroom environment survey</p> <p>Develop checklists on effective instruction</p> <p>“Things to Look For” and “Ask About”</p>

Testing and Validating Hypotheses using the ICEL/RIOT Matrix

Domain	Variables	Review	Interview	Observe	Test
<p style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 48pt; font-weight: bold; text-align: center;">Curriculum</p> <p>Curriculum refers to what is taught. Scope and sequence would be included here as well as pacing within and between topics.</p> <p>Is curriculum appropriate for student?</p> <p>Consider:</p> <ul style="list-style-type: none"> • sequencing of objectives • teaching methods • materials provided • difficulty • presentation • length • format • relevance 	<p>Group/System</p> <ul style="list-style-type: none"> • Presence of Core Curriculum • Universal behavior expectations/PBIS • Staff training in curriculum • Percentage of students at benchmark/meeting grade level expectations • Long-range direction for instruction • Alignment to standards • Instructional philosophy/approaches • Instructional materials • Stated outcomes for the course of study <p>Individual</p> <ul style="list-style-type: none"> • Accommodations • Supplementary instruction • Interventions • Access to instruction (time, attention, behavior, attendance) • Instructional materials • Arrangement of the content/instruction 	<p>Curriculum selected</p> <ul style="list-style-type: none"> • scientific researched based • implemented with integrity • integration of supplemental and intensive curriculum, as appropriate <p>Scope and sequence of textbooks and other resources</p> <p>Permanent products (e.g. books, worksheets, curriculum guides)</p> <p>Benchmarks/ Standards</p>	<p>Stakeholders about:</p> <ul style="list-style-type: none"> • Core curriculum • Support curricula used for supplemental and intensive instruction • Supplemental teaching materials • Expanded core curriculum (e.g. community skills, study skills) • Flexibility for teacher to modify curriculum • Use of data-based decision making • Philosophical orientation of curriculum (e.g. whole language, phonics, direct instruction) • Expectations of district for pacing /coverage of curriculum • Content/outcomes of course • Modifications of benchmarks made for students • Readability of textbook and other resources • Prerequisite skills/prior understanding needed for success • Allowable repetition for mastery/understanding • Technology integration • Cultural competency/relevance of the curricular content to student demographics 	<ul style="list-style-type: none"> • Peer group response to curricular demands • Target student group response to curricular demands • Variety of practice opportunities • Allowance for peer sharing/mentoring during work time • Student/peer response to curricular materials • Types of student performance options: how are students expected to demonstrate the skill/standards? 	<p>Readability/ level of text books and other resources</p> <p>Readability level/difficulties of tests</p> <p>“Things to Look For” and “Ask About”</p>

Testing and Validating Hypotheses using the ICEL/RIOT Matrix

Domain		Variables	Review	Interview	Observe	Test	
Environment	Classroom/School	<p>The classroom/school environment is where instruction takes place.</p> <p>How is the environment impacting learning?</p> <p>Consider:</p> <ul style="list-style-type: none"> • what may distract or inhibit student learning • peers • safety • seating • classroom management • noise level • technology • class size 	<ul style="list-style-type: none"> • Physical arrangement of the classroom or other problem location • Furniture/equipment • Rules • Management Plans • Routines • Expectations • Peer context • Peer and family influence • Task pressure • Adult supervision 	<ul style="list-style-type: none"> • School/ classroom rules • Physical layouts of school, classrooms, property, and buses as appropriate • Daily schedule-amount of time allocated to instruction in areas of concern. • Out of classroom time for other instruction/ supports 	<p>Stakeholders about:</p> <ul style="list-style-type: none"> • Classroom routines, rules, behavior management plans, situational expectations (e.g. classroom vs. hallway, PE, recess) and how rules were developed • Make-up of peers • (Re)organization of room's layout (e.g. desk location selection, changes) • Limited distractions area <p>School-based personnel:</p> <ul style="list-style-type: none"> • School wide discipline • In-school behavior • Peer to peer mentoring programs • Adult to peer mentoring • Counselors, school psychologists supports • Teachers • Level of family/school engagement 	<ul style="list-style-type: none"> • The physical layout/arrangement of learning spaces • Lighting/sound sources, temperature, noise levels • Environmental/other student distractions • Posting of rules, clocks, and/or daily schedule • Signal for transitions • Social expectations • Established routines versus new/novel expectations • Peer makeup • Interaction patterns • How students handle transitions in schedule 	<p>Classroom mapping</p> <p>Systematic Observation</p> <p>Teacher Working Conditions Survey</p> <p>Student Surveys</p> <p>“Things to Look For” and “Ask About”</p>
	Family/Community	<p>The family/community environment is where student spends time outside of the classroom environment.</p> <p>How is the environment impacting learning?</p> <p>Consider:</p> <ul style="list-style-type: none"> • what may distract or inhibit student learning • social /family support • nutrition • responsibilities in the home • family expectations • travel time to school • safety in the community • time demands 	<ul style="list-style-type: none"> • Resources to support learning • Parent involvement including talking to students about school, checking homework, attending events, and volunteering at school • Rules and expectations at home • Routines • Peer and family influence • Adult supervision • Cultural factors 	<ul style="list-style-type: none"> • Student attendance record • Parent/guardian participation in school open house, parent conferences, volunteer opportunities • Mobility rate • Transportation from home to school (e.g., time on bus) • Discipline records • Student support services being delivered (e.g., integrated, coordinated, offered) • Parent availability for support (parent work schedule) • Other siblings in the home and their performance at school and availability to support/mentor target student 	<p>Parents about:</p> <ul style="list-style-type: none"> • Sleep habits • Nutrition/eating habits • Homework space/time allocation • Supervision • Use of out of school time (e.g., physical activity) • Home responsibilities • Peers • Siblings • Out of school mentoring (e.g., Big Brother/Sister, church involvement, clubs) • Interference of identified difficulty on outside of school activities • Social expectations at home • Cultural factors influencing child • Consistency between parent expectations for performance and school expectations for performance • Consistency between levels of support to complete homework and levels of support in class • Level of family/school engagement 	<ul style="list-style-type: none"> • Community Activities • Club/Sports Activities • Peer interactions • Adult-student interactions 	<p>NOTE: Direct assessments may not be available for this Domain</p>

Testing and Validating Hypotheses using the ICEL/RIOT Matrix

Domain		Variables	Review	Interview	Observe	Test	
Environment	Peers	<p>The peer environment is where the instruction takes place.</p> <p>How is the peer environment impacting learning?</p> <p>Consider:</p> <ul style="list-style-type: none"> • what may distract or inhibit student learning • pressure to achieve • bullying 	<ul style="list-style-type: none"> • Belonging at school: feeling accepted, respected, and included at school • Resources and structures to support achievement • Rules and social expectations • Peer pressure • Routines • Peer and family influence • Cultural factors 	<ul style="list-style-type: none"> • Attendance records (e.g., tardy to school/classes, absences) • Discipline records • Academic performance and proficiency of peers (similar demographics) • Identify peer supports, friends, problem relationships 	<p>Peers about:</p> <ul style="list-style-type: none"> • Beliefs, self-determination • Peer group/friends • Mentoring opportunities • Club involvement • Community Involvement • Home responsibility • Goals and aspirations • Self-perceived strengths/talents • Self-perceived challenges <p>Teacher about:</p> <ul style="list-style-type: none"> • Perception of student/peer group interaction • Peer reinforcement of compliance or noncompliance <p>Student about Peer Factors:</p> <ul style="list-style-type: none"> • The degree to which peers influence work completion, compliance, motivation, target behavior 	<ul style="list-style-type: none"> • Classroom behavior (e.g., class participation, work completion, engagement) • Social Settings (e.g., in-school/hall/Cafeteria behavior and interactions) • Interaction of peer to peer • Interaction of target student with peers • Observation protocols to compare performance (e.g., on task, work completed, questions asked, compliance) to same demographic peers. • Compare peer time to complete work to target student time to complete work. 	<p>Note: Direct assessments may not be available for this Domain</p>

Testing and Validating Hypotheses using the ICEL/RIOT Matrix

	Domain	Variables	Review	Interview	Observe	Test
Learner	<p>The learner is who is being taught.</p> <p><u>This is the last domain that is considered</u> and is only addressed when the curriculum and instruction are found to be appropriate and the environment is accommodating.</p> <p>Variables include motivation, prerequisite skills, organization/study habits, abilities, impairments, and history of instruction.</p>	<ul style="list-style-type: none"> • Student’s current knowledge, or ‘prior knowledge’ • Academic performance data • Attendance record • Social/behavioral performance data • Student’s skills and motivation • Curriculum and instruction are appropriate • Student’s ‘ability’ • Family history • Demographic factors 	<ul style="list-style-type: none"> •Product vs. peer product •Cumulative file/ records •Health records, including vision and hearing •Teacher’s grade book •Assignment notebook •Previous interventions if available •Patterns of performance, including attendance, retention, and moves •Error analysis of permanent product •Response to interventions as reflected by systematic progress monitoring •Behavior history 	<p>Student about:</p> <ul style="list-style-type: none"> •Self-perceived strengths/talents •Self-perceived challenges •Ideas about what s/he needs •Personal adjustment •Beliefs, self-determination •Peer group/friends •Mentoring opportunities •Club involvement •Community Involvement •Home responsibility •Goals and aspirations <p>Parents about:</p> <ul style="list-style-type: none"> •Health issues impacting learning •Orthopedic or neurological issues •Hearing/vision checks •Perceptions on learning, behavior, speech, or motor difficulties •Family engagement in school activities (e.g., homework support) 	<ul style="list-style-type: none"> • Student’s learning style match for instruction • Use of supportive technology • Target behavior, antecedents, conditions, consequences • Dimensions and nature of the problem • Student/group transitions • Large group instruction • Small group instruction • Independent work time • group work time • Time on task • External supports necessary to sustain engagement • Processing directions • Cultural factors • Access barriers • Interactions 	<ul style="list-style-type: none"> •“Things to Look For” and “Ask About” •Standardized academic assessments •Cognitive assessments •Preference/ interest inventories •Motivation scales •Personal adjustment & behavior rating scales •Progress monitoring •Response to interventions •FBA - nature and dimensions of behavior (frequency, duration, latency, intensity), including anecdotal notes •Physical fitness •Physical health •Social emotional well-being •Student effort checklist