

Assessing engagement with construction-based, structured-play activities designed for the teaching and learning of the language of metacognition in a primary Pupil Referral Unit: Appendix A

Table A1: Engagement indicators	
Dimension	Indicators
<i>Cognitive engagement Cognitive and metacognitive processes, and their quality, as they relate to conduct of the task. Also includes behaviours – such as gestures – and tool use – such as diagrams – that facilitate cognitive and metacognitive processes.</i>	Verbalising cognition, private speech and exploratory talk
	Application of metacognitive processes and self-regulated learning strategies
	Purposeful thought and action (e.g., careful consideration of strategies)
	Gestures that facilitate cognition; use of tools, mental or physical, that facilitate cognition.
	Seeking information, feedback, or help
	Interaction and communication related to task, metacognition, or self-regulated learning, such as exchanging ideas, answering questions, making evaluative comments, assisting others in using manipulatives
	Preference for challenge
	Behaviours representing care and attention: studiousness, fastidiousness, thoroughness
	Investment in task (rather than superficial learning/participation/action)
	Elaboration beyond requirements, either in communication or action
	Avoidance (negative)
	Desultory approach to task (negative)
Indiscriminate application of strategies (negative)	
<i>Behavioural engagement Actions, attention and effort as they relate to the learning experience.</i>	Amount and quality of on-task performance
	Effort, persistence, perseverance
	Active involvement
	Concentration
	Attention directed and maintained towards task
	Resists distraction, actively manipulates environment to minimise/counter distraction
	Disruption (negative)
	Restlessness (negative)
	Distraction (negative)
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Dimensions	Indicators
Emotional engagement <i>Affect, volitional (willed by the individual) or imposed (elicited in the individual due to the nature of the task), as it relates to the learning experience.</i>	Enthusiasm
	Interest
	Enjoyment
	Satisfaction
	Pride
	Boredom (negative)
	Frustration (negative)
	Disinterest (negative)
Agentic engagement <i>Extent of participation in shaping the learning experience.</i>	Offering suggestions
	Asking questions
	Expressing interest
	Communicates preferences, likes and dislikes
	Actively modifies or re-organises task or educational setting in an attempt to enrich the learning experience
	Actively engages/disengages with others in an attempt to enrich their/other's learning experience
	Actively resists participation (negative)
	Unresponsive (negative)
	Sabotages their own participation (negative)
The indicators are derived from numerous sources: Fredricks et al. (2004), Greene et al. (2004), Helme and Clarke (2001), Lee and Reeve (2012), Nguyen et al. (2018), Nystrand and Gamoran (1991), Pekrun (2006), Philp and Duchesne (2016), Reeve (2012), Reeve and Tseng (2011), Skinner et al. (2009a), Skinner and Pitzer (2012).	

Table A2: Engagement scale		
Engagement level	Description	Relationship to engagement dimensions
5	Possible 'flow'*. High levels of positive affect. Prolonged investment in task and resists distractions. Keen to explore, investigate, and elaborate.	Positive and intense indicators across dimensions. May be assigned if a dimension is sufficiently intense (e.g., strong positive affect). * "Flow" refers to a high level of unyielding focus in a pleasurable and challenging activity (Addessi et al., 2015).
4	Active participation in task and discussions. Meaningful responses to questions. Minimal prompting required. May express positive affect toward the task and may elaborate on task requirements.	Positive indicators across dimensions. Can be assigned if there are no negative indicators for a dimension, providing there are sufficient positive indicators in other dimensions (e.g., positive cognitive and behavioural indicators, but no emotional indicators).
3	Engages in task. Responds to questions, but responses may be pedestrian. May require some prompting by staff.	Some weak but positive indicators of cognitive and behavioural engagement. Occasional and weak signs of negative indicators across all dimensions.
2	Minimal or fleeting involvement in task and discussions. Perfunctory responses to questions. Requires a lot of effort by staff. Easily distracted.	Cognitive and behavioural indicators oscillate between weak positive and more strongly negative indicators. Negative or no emotional indicators.
1	No demonstrable engagement in task. Off-task. Expressing no interest. Engaged in another task (may be within same activity).	Negative indicators across dimensions. Can be assigned if there are no negative indicators for a dimension, providing there are sufficient negative indicators in other dimensions (e.g., negative cognitive and behavioural indicators, but no emotional indicators).

Table A3: LEGO activity: SRL-planning stage: Engagement levels with indicators		
Level	Dimension	Example
4	Behavioural	<i>Charles and Peter are actively involved in arranging the build-stage images.</i>
	Behavioural	<i>Student displays persistence. Charles, for example, has to re-arrange the images on a number of occasions, and seeks help, yet perseveres.</i>
	Cognitive	<i>Student is concentrating on the task: attentive, observant.</i>
	Cognitive	<i>Peter answers questions addressed to the class.</i>
	Emotional	<i>Charles and Peter display interest.</i>
3	Cognitive	<i>Charles and Peter perform are actively engaged in the task, but mechanically.</i>
	Behavioural	<i>Students are at their workstation and on-task</i>
	Emotional	<i>Unenthusiastic, expressionless</i>
2	Behavioural	<i>Rupert is not participating in task</i>
	Behavioural	<i>Slouched in chair, arms folded</i>
	Cognitive	<i>Off-task, not focused (staring at table)</i>
	Emotional	<i>Rupert is frowning, not interested in communicating with teaching assistant who is helping him</i>

Table A4: LEGO activity: Build-process stage: Engagement levels with indicators

Level	Dimension	Example
5	Emotional	<i>High degree of positive affect: Charles is animated and verbalises his enthusiasm and enjoyment.</i>
	Cognitive	<i>Attentive commitment – absorbed in the activity.</i>
	Cognitive	<i>Talking to the activity.</i>
	Behavioural	<i>Highly focused; inability of environmental stimuli to penetrate focus.</i>
4	Cognitive	<i>Charles and Rupert verbalise their thoughts, expressing task appropriate thinking – “Two... Four... One more... That one...”; “this bit goes...”.</i>
	Agentic	<i>Peter elaborates upon the original design, adding bespoke flourishes.</i>
	Emotional	<i>Students display enthusiasm – leaning forward, alert, and manipulating the resources in front of them.</i>
	Emotional	<i>Students express their excitement as the model begins to take shape – a “c’mon, yeah!” from Charles as he adds grilles to the shuttle’s payload bay doors; a “Ready? Ta dah!” from Rupert, as he triumphantly displays the skeletal frame of a monster truck; a “Miss V., I’ve got mirrors... that move! Mr. Linale, I’ve now got mirrors that move!” from Peter, as he shows staff the folding wing mirrors of his sportscar.</i>
	Behavioural	<i>Students are actively engaged in appropriate on-task behaviour for the majority of the build process.</i>
Behavioural	<i>Students endeavour to correct errors themselves when they encounter them.</i>	

Table A5: LEGO activity: SRL-monitoring stage: Engagement levels with indicators		
Level	Dimension	Example
5	Emotional	<i>Charles yells, “Monitoring! Tick! Tick! Tick!” and throws his hands up (‘tick’ being a reference to using a green tick to record a monitoring stage).</i>
4	Cognitive	<i>Charles and Rupert would maintain their own opinions, and not simply ‘accept’ the opinion of others. Suggests genuine deliberation.</i>
	Cognitive	<i>Students would make considered contributions to the task – in selecting keywords and in the discussion.</i>
	Behavioural	<i>Students are actively demonstrating appropriate on-task behaviour for the majority of the monitoring stage.</i>
	Behavioural	<i>Students resist distraction – Charles mostly ignores the conversation between Peter and Rupert. They ignore ‘general goings-on’ in the classroom, such as staff conversing, and the resident dog milling around.</i>
	Emotional	<i>Students display enthusiasm – leaning forward, alert, and manipulating the resources in front of them.</i>
3	Cognitive	<i>Students mostly demonstrate appropriate thought and action, but the investment is minimal.</i>
	Cognitive	<i>No substantive attempt is made to articulate their thought. Students’ responses are laconic.</i>
	Behavioural	<i>Peter busies himself with distractions, such as manipulating the model, momentarily turning away, or swinging his arms around.</i>
	Behavioural	<i>Peter is slouched in chair, gaze is occasionally directed elsewhere.</i>
	Emotional	<i>Students’ exhibit a listless demeanour, expressionless.</i>
	Emotional	<i>Students show lack of colour or energy in responses.</i>
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Level	Dimension	Example
2	Cognitive	<i>No significant contribution to the task; passive.</i>
	Cognitive	<i>Any attempts at task or discussion are perfunctory.</i>
	Behaviour	<i>Peter is restless – standing and faintly swinging his body, occasionally re-orienting himself as if desiring to engage in something else.</i>
	Behaviour	<i>Peter is easily distracted – remains in close proximity to his station, but attempts to engage others in discussion.</i>
	Emotional	<i>At times, Peter stares blankly; expressionless demeanour.</i>
	Emotional	<i>Spiritless responses tend to drift off.</i>

Table A6: LEGO activity: SRL-reviewing stage: Engagement levels with indicators		
Level	Dimension	Example
4	Cognitive	<i>Charles would make considered contributions to the task – in selecting keywords and in the discussion.</i>
	Cognitive	<i>Charles offers extended and meaningful responses to questions.</i>
	Behavioural	<i>Charles is actively engaged in appropriate on-task behaviour for the majority of the reviewing stage.</i>
	Behavioural	<i>Charles is sitting, later standing, at his workstation, interacting with the metacognition resources as we discuss them.</i>
	Emotional	<i><there are no strong emotional indicators, judgement for level 4 is determined by cognitive and behavioural indicators></i>
3	Cognitive	<i>Students' responses are cursory.</i>
	Cognitive	<i>Peter shows little attention to the placement of keywords, assigning them to incorrect SRL stages.</i>
	Behavioural	<i>Charles is standing and fidgeting with the chair, but still contributing (signs of becoming restless).</i>
	Behavioural	<i>Peter is at the workstation and participating, inspecting keywords.</i>
	Emotional	<i>Affect is nondescript – no strong signs of either positive or negative affect.</i>
	Emotional	<i>Peter's responses have an insipid quality.</i>
2	Cognitive	<i>Desultory responses to questions.</i>
	Cognitive	<i>"Your..." Peter's response to a question trails off. "What are you going to do?" I prompt him. "You're looking at it, and making sure it is good..."</i>
	Behavioural	<i>Peter is sitting at his workstation and flipping through the instruction booklet.</i>
	Behavioural	<i>Peter largely ignores any interaction and is looking through the box of spare pieces.</i>
	Emotional	<i>No emotional investment in task, directs enthusiasm towards elaborating model using spare pieces.</i>
1	Cognitive	<i>No on-task contributions.</i>
	Cognitive	<i>Peter avoids engagement in discussion – changes subject, or offers no substantial response.</i>
	Behavioural	<i>Restless, frequently orienting body away from workstation.</i>
	Behavioural	<i>Peter is not interacting in any meaningful way, is playing with the recently completed model.</i>
	Emotional	<i>Signs of agitation: "why is this so confusing (inaudible) me?"</i>

Table A7: Marble-run activity: SRL-planning stage: Engagement levels with indicators

Engagement		
Level	Dimension	Example
4	Cognitive	<i>Peter deduces and attends to important features of the instructions that assist in determining the correct sequence.</i>
	Cognitive	<i>Charles is fastidiously organising the laminated sheets that constitute the plan.</i>
	Cognitive	<i>Rupert asks questions as I arrange his instructions on the planning section of the metacognition board.</i>
	Agentic	<i>Rupert begins identifying keywords related to 'metacognitive skills' he predicts he will use in the activity.</i>
	Behavioural	<i>Peter is focused and committed to setting out the plan in the correct order, arranging and re-arranging as necessary.</i>
	Emotional	<i>Peter is energetic as he moves around his workstation.</i>
	Emotional	<i>Rupert has an animated tone as he talks about the activity.</i>
3	Cognitive	<i>Charles is actively participating, but he does not demonstrate extended thoughtfulness to address challenges, rather relying on staff for assistance.</i>
	Behavioural	<i>Charles perseveres, but there are instances of discouragement in which he requires support.</i>
	Emotional	<i>Charles has slight morose, defeatist character as he speaks – "Don't know...", "There are so many things..."</i>

Table A8: Marble-run activity: Build-process stage: Engagement levels with indicators		
Level	Dimension	Example
5	Emotional	<i>High degree of positive affect: Charles is animated and verbalises his enthusiasm and enjoyment – “Jamie! Nah, this is going to be too good! Nah, Jamie! nah, nah, nah, Jamie! Jamie! That’s going to be too good.”</i>
	Cognitive	<i>Charles is enthusiastic both to offer suggestions on how to elaborate the marble run beyond the plans and to contribute to the implementation of these ideas.</i>
	Behavioural	<i>Undeterred by failed tests, Charles maintains positive affect and, without hesitation, begins making adjustments to the track ready for the next test.</i>
	Emotional	<i>Charles is ebullient; an affect undampened by set back or difficulty.</i>
4	Cognitive	<i>After testing, Charles makes sensible decisions about which parts of the track to adjust and how to adjust them.</i>
	Cognitive	<i>Rupert contemplates the plan for an extended period. He raises his hand to his mouth occasionally, swings a foot back and forth, and leans over the laminate sheets of the plan posted on the metacognition board.</i>
	Agentic	<i>Having completed a section of the marble run, Peter sets about testing it with two marbles – as per the instructions –, and then with three and four marbles. “I just wanna test something... I wanna test something... I want to try something quickly.”</i>
	Agentic	<i>Charles and Peter work collaboratively on implementing their own design to expand Charles’ original marble run.</i>
	Emotional	<i>Students express their emotions as the marble winds its way around the track – a “yes, go on!” from Charles.</i>
	Emotional	<i>Charles: “Oh, it went! Oh, it went! Jamie, it works!”; “Ehhh, Jamie let’s gooooo!”</i>
	Emotional	<i>Student’s show signs of ownership and pride, such as Peter inviting Rupert and members of staff to witness the demonstration of his marble run in action. Students refer to the models as ‘my’ and ‘mine’.</i>
	Behavioural	<i>Students demonstrate considerable perseverance – if the marble stops or falls from the track, students will adjust the track and try again, they will do this repeatedly. This can be accompanied by jocular verbalisations such as “one last try!”, followed by “one last try!”, and another “one last try!”</i>
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Level	Dimension	Example
3	Behavioural	<i>Charles is seated at his station but engaged in conversation with Peter.</i>
	Behavioural	<i>Charles is pacing about his workstation, waiting to begin.</i>
'low' 3	Cognitive	<i>Charles is engaged in the activity, but his conduct of task activities is languid and appears directionless.</i>
	Behavioural	<i>Charles sits and fiddles with the sections of track in front of him.</i>
	Behavioural	<i>Charles remains at his workstation, but periodically directs his attention to other events.</i>
	Emotional	<i>Charles has a dour expression and the realisation that he has to exert effort – locating a piece of track – dejects him.</i>
	Emotional	<i>Charles rubs his brow with the palm of his hand. "No, no, no, no, no..."</i>
	Emotional	<i>Peter is frustrated by unsuccessful trials – he sits down, arms loose and throws his head back –, but he returns to the build process.</i>
2	Behavioural	<i>Charles drifts about around his workstation. He picks up pieces only to put them back down again.</i>
	Emotional	<i>Charles lets out a long, tired groan.</i>
	Emotional	<i>Charles, seated, drops his head into the bend of his arm and lies there in a torpid condition.</i>
	Behavioural	<i>Students are more susceptible to distractions such as the phone ringing.</i>
	Cognitive	<i>Peter is constructing arbitrary objects with spare pieces.</i>
	Behavioural	<i>Students enquire as to when lunch is ready.</i>
	Cognitive	<i>Students suggest they might like to play basketball, instead.</i>
1	Cognitive	<i>Charles displays no cognitive engagement in task; opposes any attempt made to engage him in the task.</i>
	Behavioural	<i>Charles slumps down, sits cross-legged, and puts his head in his lap.</i>
	Emotional(?)	<i>Charles grumbles about having had to disassemble parts of the marble run at the end of the previous session.</i>
	Behavioural	<i>Peter and Charles are using spare parts in symbolic play.</i>

Table A9: Marble-run activity: SRL-monitoring stage: Engagement levels with indicators		
Level	Dimension	Example
5	Emotional	<i>Charles is ebullient (this appears to have carried over from the build process).</i>
	Emotional	<i>Charles is talkative with a cheerful, high-spirited tone.</i>
4	Cognitive	<i>Students would make considered contributions to task, in selecting keywords and in the discussion.</i>
	Cognitive	<i>Rupert and Charles would both make attempts at extended articulations when relating the keywords to metacognitive processes during the build process.</i>
	Behavioural	<i>Rupert is actively participating in on-task behaviours, such as scanning keywords.</i>
	Behavioural	<i>Students are actively engaged in appropriate on-task behaviour for the majority of the monitoring stage.</i>
	Emotional	<i>Charles is enthusiastic when selecting: “Noticing! Working together! Thinking! Trying other ways!”</i>
3	Cognitive	<i>Students participated in discussion, but input was minimal.</i>
	Behavioural	<i>Charles is rocking in his chair, occasionally looking elsewhere.</i>
	Emotional	<i>Students’ exhibit a listless demeanour, expressionless.</i>
	Emotional	<i>Students show lack of colour or energy in responses.</i>
2	Cognitive	<i>Peter offers only vocable and monosyllabic responses – “yep”, “mhmm” – to questions.</i>
	Behavioural	<i>Peter offers minimal response and instead continues to test his marble run.</i>
	Behavioural	<i>Charles attends to the activity, but often removes himself and paces the room.</i>
	Behavioural	<i>Peter acknowledges comments from Charles and me, but is at a distance working on the marble run.</i>