

Semantic Grammar Rubric Expression Language (SGREL) Scoring vs. Machine Learning & Deep Learning		
	Semantic Grammar (SGREL) Approach to scoring Examinee response	Machine Learning (BOW) Approach to scoring Examinee response
Response processing paradigm	Processes text as sentences made up of words. Resolve external references / antecedents, consider part-of-speech usage	Processes text as 'bag of words'. Consider words and their adjacency, part of speech as attribute.
Focus / Technique	Leverage item author intent reflected in item specific rubric, WordNet and other sources of semantic context bolster author intent as reflected in the rubric.	Computational linguistics: word (vocabulary) vectors (e.g. term frequency / inverse document frequency measures, or tf-idf) and some limited adjacency / structure.
Modeling	Tests for presence / absence of concepts; item author supplied weightings and scoring formula. Can target misconceptions for additional feedback.	occurrences of words, word pairs, word trigrams, part-of-speech pairs, coh-matrix factors. Expert-scored examples provide data for factor identification and weighting.
Match to	Item-specific rubric-relevant expressions - presence or absence of evidence of understanding or misunderstanding.	Patterns detected from "training set" (expert scored) responses
Feedback based on	<p>Feedback based on rubric expression associated with response text.</p> <p style="text-align: center;"><i>concrete, actionable feedback</i></p> <p>i.e. "Your response does not capture the expected thesis statement or closely related information. Your response should identify the central analogy of the text (Saeng's need to adapt to her new surroundings, as the winter hibiscus adapted to its new environment).¹</p>	<p>Feedback based on patterns associated with scoring labels.</p> <p style="text-align: center;"><i>holistic, probabilistic associations</i></p> <p>i.e. "Consider strengthening your thesis statement"</p>
Path to Improvement	<ol style="list-style-type: none"> 1. More precise concept expression 2. More flexible concept expression 3. More accurate concept recognition 4. Transformation to a "deep learning" approach based on semantics, not vocabulary 	<ol style="list-style-type: none"> 1. More complex features (e.g. coh-matrix) 2. Capture more structure and context 3. Transformation to a semantic, Watson-like domain knowledge-based approach 4. Other?
Challenges	Tension between over-broad concept expression and too-narrow / insufficiently robust concept recognition	Modeling for rubric-relevant feedback and holistic scoring consistency often produce incongruent results (overall score not consistent with sum of sub-score modeling results)

¹ See additional examples on the next page.

Additional feedback examples:

Semantic Grammar Rubric Expression Language (SGREL) Winter Hibiscus Rubric Elements and Feedback		
Response Element	This response received credit because it:	This response could be improved by:
(only one PC TRE will apply)		
Claim satisfies pc-tre1	Articulates the central elements of the underlying analogy between adaptation of the hibiscus to a new land and the adaptation of immigrants to their new land.	n/a (max score).
Claim satisfies pc-tre2	Articulates important elements of the underlying central analogy: adaptation, for the winter hibiscus or the immigrants, requires work, change, accommodation and growth.	More specifically identifying the analogy between the adaptation of winter hibiscus and the adaptation of the immigrants. Adaptation required by both parties is central to the analogy.
Claim satisfies pc-tre3	Articulates some elements of the underlying central analogy of adaptation for both the hibiscus and the immigrants: work, growth, change or determination and the struggle to survive.	Recognize explicitly the essential nature of <i>adaptation</i> or <i>change</i> to accommodate differences in the environment by [the winter hibiscus the immigrants] (whichever is missing).
Claim satisfies pc-tre4	Articulates one or more minimal elements of the underlying central analogy of adaptation for both the hibiscus and the immigrants: work, growth or determination and the struggle to survive.	Recognize explicitly the essential nature of <i>adaptation</i> or <i>change</i> to accommodate differences in the environment <i>by both</i> the winter hibiscus and the immigrants.
General Feedback for pc-tre-2-4:	Your response should identify the central analogy of the text (Saeng’s need to adapt to her new surroundings, as the winter hibiscus adapted to its new environment) and cite evidence to support this claim.	
	if found	if not found
Evidence from ev-tre1	Evidence that the winter hibiscus in the new land was different from the hibiscus from home (“not like before”, “not real”) shows the importance of change to survival in new circumstances.	The response could cite ways the winter hibiscus in the new land was different from the hibiscus of their former home: not as pretty, but hearty enough to make it through the cold winter.
Evidence from ev-tre2	The observation that the winter hibiscus was not as pretty reinforces that adaptation can be seen for both what is lost and what is gained.	Specifically citing that Mrs. Panouvong noted that the winter hibiscus was not as pretty illustrates change as part of adaptation.

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Evidence from ev-tre3	The observation that the winter hibiscus was strong enough to survive the winter illustrates adaptation for survival.	Specifically citing that Mrs. Panouvong noted that the winter hibiscus was strong enough to survive the winter illustrates change as part of adaptation and the importance of survival.
Evidence from ev-tre4	Noting Ms. Panouvong’s indifference to the cold, or her focus on survival, support her recognition that adaptation is important to survival.	Specifically noting Mrs. Panouvong’s indifference to the cold, or insistence on the importance of survival, could reinforce analogy of adaptation for the immigrants as was being observed of the hibiscus.
Evidence from ev-tre5	Adaptation and determination are important and necessary for survival.	Specifically noting that Mrs. Panouvong had highlighted the importance of survival above all else in her observation of the winter hibiscus supports the adaptation analogy, as does the determination Saeng shows to be succeed in her new land.
Evidence from ev-tre6	Noting that the winter hibiscus has much in common with the hibiscus of their former home --	Noting specifically how the winter hibiscus was like the hibiscus of their homeland -- red blossoms, five petals, long yellow-tipped stamen -- or the “expected” cool / velvet / smooth petal center -- is evidence to support the theory of adaptation, rather that the flower being regarded as simply a similar plant.
Note	Scoring formula and element weights are described elsewhere.	