

### SRL Coding Scheme

Classes, Descriptions, and Examples of the Processes Used to Code Learners' Self-Regulatory Behavior  
(Based on Azevedo, Cromley, & Seibert 2004)

Class Process [Abbreviation]	Description <sup>1</sup>	Student Example from Think-Aloud Protocols
<b>Planning</b>		
Planning [PLAN]	Learner states two or more learning sub-goals for future activity, or carries out the coordination of multiple learning goals into an organized plan for learning activity.	"First, I want to learn about the different parts of the heart, and then the blood vessels."
Prior Knowledge Activation [PKA]	Learner searches memory for relevant prior knowledge either before starting the learning task or during task performance.	<i>"Gamma globulin is composed of tens of thousands of unique antibody molecules<sup>2</sup>. I think they, I remember, um, they are like part of the immune system."</i>
Recycle Goal in Working Memory [RGWM]	Learner restates either the overall learning goal or self-set sub-goal in working memory.	"I need to learn about all the parts and their purposes...I need to learn about all the parts and their purposes."
Sub-Goal [SG]	Learner articulates a specific sub-goal that is relevant to the experimenter-provided overall goal and/or learner-generated goal. Must verbalize the sub-goal immediately before clicking on a relevant sub-section and carry out some action relevant to sub-goal at some later point.	"I want to learn more about plasma. I'm going to click on that."
Time and Effort Planning [TEP]	Learner attempts to intentionally control his/her behavior by selecting specific content from the learning environment and adjusting effort allocated to completing the remainder of the task. Plans for behavior are controlled in relation to amount of time remaining in the learning task.	"I'm skipping over that section since 45 minutes is too short to get into all the details."

<sup>1</sup> All codes refer to what was recorded from the think-aloud protocols and video analysis

<sup>2</sup> Italics signify reading of text presented in the hypermedia environment

Class Process [Abbreviation]	Description	Student Example from Think-Aloud Protocols
<b>Monitoring</b>		
Content Evaluation Positive [CE+]	Learner states that any just-seen external representation (e.g., text, diagram, or video) in the learning environment is relevant to either the overall learning goal or self-set sub-goals.	[Learner reads about red blood cells] "This is just was I was looking for."
Content Evaluation Negative [CE-]	Learner states that any just-seen external representation (e.g., text, diagram, or video) in the learning environment is irrelevant, in relation to either the overall learning goal or self-set sub-goal.	"I'm reading through the text on white blood cells, but it's not specific enough for what I'm looking for on the topic veins."
Expectation of Adequacy of Content Positive [EAC+]	Learner expects that a certain content that is about to be accessed (e.g., section of text, diagram, video) will be adequate given either the overall learning goal or self-set sub-goals. This can include content which has or has not yet been accessed previously within the learning session.	"I'm going to actually look on the picture because that will help me understand"  OR  "This video that I saw before will help me."
Expectation of Adequacy of Content Negative [EAC-]	Learner expects that a certain content which the learner chooses not to navigate toward at that time (e.g., section of text, diagram, video) is not adequate given either the overall learning goal or self-set sub-goals.	"This picture will not help me."
Feeling of Knowing Positive [FOK+]	Learner is aware of having read or learned something in the past, either within the learning session or before engaging in the learning task.	"Oh, I already read that."  OR  "I read that somewhere in a magazine."
Feeling of Knowing Negative [FOK-]	Learner is aware of having not read or learned something in the past.	"I didn't know that."
Judgment of Learning Positive [JOL+]	Learner becomes aware that he or she has developed some understanding of the current material (can be regarding any of the multiple external representations within the content).	"Okay, this makes sense."
Judgment of Learning Negative [JOL-]	Learner becomes aware that he or she does not understand the current material (can be regarding any of the multiple external representations within the content).	"I don't understand this."

Class Process [Abbreviation]	Description	Student Example from Think-Aloud Protocols
Monitor Progress Toward Goals [MPTG]	Learner assesses whether previously-set sub-goal has been met, in relation to the overall learning goal. Learner indicates completion of a sub-goal, or that a particular sub-goal is still not complete.	“Those were our goals..I accomplished them.”  OR  “I still haven’t found out what the flow of blood through the heart is.”
Monitor Use of Strategies [MUS]	Learner comments on how useful a strategy which he or she deployed is/was in meeting either the overall learning goal or self-set sub-goal, understanding the domain, or integrating multiple external representations.	“Yeah, drawing really helped me understand how blood flow throughout the heart.”
Self-Test [ST]	Learner explicitly states he or she is going to attempt to recall information to test understanding. This may or may not include generating a question directed towards oneself.	“Let me see if I’ve got this down...”
Time Monitoring [TM]	Learner refers to the number of minutes remaining in the learning session.	“There are a few seconds left”

**Learning Strategies**

Coordinating Informational Sources [COIS]	Learner verbalizes or behaviorally indicates (e.g., pointing) the correspondence between elements of two or more external representations of information (e.g., text and diagram), in an attempt to integrate the two representations internally. External representations which are coordinated can be in the learning environment or in learner’s notes. COIS does not include simply reading the entire text and then inspecting the diagram – it must be <i>coordinated</i> utilization of two or more representations. COIS is always coded from the hardcopy of transcript and then confirmed using the video by observing behavioral manifestations of the process.	“I’m going to put that [text] together with the diagram.”
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Class Process [Abbreviation]	Description	Student Example from Think-Aloud Protocols
Control Video [CV]	Learner uses the control panel that is part of an animation (e.g., pause, stop, rewind) to control the pace of an animation which is part of the computer-based learning environment.	VIDEO: <i>Then the heart relaxes, the aortic and pulmonary valves close, and diastole starts again</i> [learner rewinds video] <i>Then the heart relaxes, the aortic and pulmonary valves close, and diastole starts again</i>
Draw [DRAW]	Learner creates a drawing or diagram to assist in his or her learning, or integration of two different external representations. DRAW is always coded from the hardcopy of transcript and then confirmed using the video by observing behavioral manifestations of the process.	"...I'm trying to draw the diagram as best as possible."
Inference Positive [INF+]	Learner draws a correct conclusion based on two or more pieces of information that were read within the same paragraph in the computer-based learning environment (can be regarding any of the multiple external representations within the content).	<i>"Hypertension is elevated blood pressure, develops when the blood- body's blood vessels narrow, causing the heart to pump harder, Which I'm guessing could cause a heart attack."</i>
Inference Negative [INF-]	Learner draws an incorrect conclusion based on two or more pieces of information that were read within the same paragraph in the computer-based learning environment (can be regarding any of the multiple external representations within the content).	<i>"So the blood goes from the right atrium to the left atrium, then to the left ventricle, and finally to the right ventricle."</i>
Knowledge Elaboration [KE]	Learner elaborates on what was just read, seen, or heard with prior knowledge, either from before the learning session, or from a prior paragraph or different external representations within the learning environment. Analogies (e.g., "like a car radiator") and comparisons with previous conceptions (e.g., "that's smaller than I expected") are coded as KE.	<i>"Heat dissipates through the skin, effectively lowering the temperature. Like a car radiator."</i>  OR  <i>"...through the mitral valve into the left ventricle. Like the tricuspid valve into the right ventricle from earlier."</i>

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Class Process [Abbreviation]	Description	Student Example from Think-Aloud Protocols
Memorization [MEM]	Learner attempts to memorize some portion of the text, diagram, etc. When reading labels from diagrams (in a systematic manner), the first recitation is coded as summarization (SUM), the second is re-reading (RR), and the third (and additional times), memorization (MEM).	"I'm going to try to memorize this picture."
Mnemonic [MNEM]	Learner uses a mnemonic to attempt to encode information from the learning environment.	"Arteries—A for away."
Preview [PREV]	Learner reads headings or subheadings in text or headings/captions of diagrams/video, prior to committing to the encoding and storing of the information within the representation.	"Systemic circulation, pulmonary circulation, additional functions, blood pressure..."
Review Notes [RN]	Learner reads over his/her own notes, drawings, etc. RN is always coded from the hardcopy of transcript and then confirmed using the video by observing behavioral manifestations of the process.	"Let me read over these notes now."
Re-reading [RR]	Learner re-reads or revisits a section of the computer-based learning environment. The re-reading of text must include five or more words from the previously-read material. If a learner reads a segment of text a third time, it is coded as memorization (MEM).	"I'm reading this again."
Search [SEARCH]	Learner searches the computer-based learning environment for a particular external representation, content on a particular topic (relative to a previously-set sub-goal), or free-searches the environment for new information.	[Learner types in blood circulation in the search feature of the hypermedia environment]

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Class Process [Abbreviation]	Description	Student Example from Think-Aloud Protocols
Summarization (Correct) [SUM+]	Learner correctly restates, in his or her own words, what was just read, inspected, or heard within the computer-based learning environment. When reading labels from diagrams (in a systematic manner), the first recitation is coded as summarization (SUM), the second is re-read, and the third (and additional times), memorization. SUM is always coded from the hardcopy of transcript and then confirmed using the video by observing behavioral manifestations of the process (to assure that learner is not taking notes, rather than summarizing).	"Um, so um, the blood starts by entering through the inferior vena cava and the superior vena cava, and then it goes into the right-the right atrium."
Summarization (Incorrect) [SUM-]	Learner incorrectly restates, in his or her own words, what was just read, inspected, or heard in the computer-based learning environment. When reading labels from diagrams (in a systematic manner), the first recitation is coded as summarization (SUM), the second is re-reading (RR), and the third (and additional times), memorization (MEM). SUM is always coded from the hardcopy of transcript and then confirmed through the video by observing behavioral manifestations of the process (to assure that learner is not taking notes, rather than summarizing).	"Ok, so it goes from the right atrium to left atrium, then left ventricle, right ventricle."
Taking Notes [TN]	Learner writes down information in his or her own external representation. TN is always coded from the hardcopy of transcript and then confirmed through the video by observing behavioral manifestations of the process.	"I'm going to write that under heart."

**Task Difficulty and Demands**

Help Seeking Behavior [HSB]	Learner seeks assistance from the experimenter or tutor regarding either the adequacy of their understanding or their learning behavior, regardless of whether the instructions indicate that the experimenter/tutor will provide assistance.	"Does it transport the blood back into your body?"
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Task Difficulty [TD]	Learner indicates one of the following: (1) the task is either easy or difficult, (2) the questions are either simple or difficult, (3) using the computer-based learning environment is easier or more difficult than using a book.	"This is really hard."
<b>Interest</b>		
Interest Positive [INT+]	Learner expresses some interest in the task or in the content domain of the task, used for any representation.	"This stuff is interesting."
Interest Negative [INT-]	Learner expresses a low level of interest in the task or in the content domain of the task, used for any representation.	"Boring"
<b>Affect</b>		
Affect Positive [AFF+]	Learner expresses positive feelings of affect in relation to the content.	"Oh, that makes me happy."
Affect Negative [AFF-]	Learner expresses negative feelings of affect in relation to the content.	"That makes me sad."
<b>No Code</b>		
No Code [NC]	Learner utters more than two words which are incompatible with the SRL codes. Typically includes 1) vague statements that do not provide enough information to conclude whether a strategy is being used, 2) partial strategy use, such as stating an intended sub-goal, yet not following through with that sub-goal.	"I'm going to the heart article" [not SG because reason for behavior not explicitly stated]  OR  "Ok, moving on."