Summary of

Active-Constructive-Interactive: A Conceptual Framework for Differentiating Learning Activities

Michelene T. H. Chi

Psychology in Education, Arizona State University

Full-length publication: Topics in Cognitive Science 1 (2009) 73–105
ISSN: 1756-8757 print / 1756-8765 online
DOI: 10.1111/j.1756-8765.2008.01005.x

Summary provided by Serge Madhere.

"Active," "constructive," and "interactive" are terms that are commonly used in the cognitive and learning sciences. Although all three terms view learners as active participants in their own learning experiences, are these three terms distinct? Can they be differentiated in terms of both the overt activities and their corresponding internal cognitive processes?

Although the three terms—active, constructive, and interactive—have been used extensively in the literature, only constructive has been defined more explicitly and frequently, such as that it is meaningful learning in which a learner actively builds a mental model of the system she is to learn (Mayer & Wittrock, 1996). The term constructivism is often used to mean discovery learning. The contrast here is between learning from being told (direct instruction) versus learning from discovering on one's own (in which students construct the rules and relationships they need). The other two terms—active and interactive, have received much less attention in terms of explicit definitions.

The goal of this paper is to provide a framework differentiating active, constructive, and interactive, in terms of their overt activities and their potential corresponding cognitive processes.

The conceptual framework to be presented here views being active, constructive, and interactive as types of overt learning activities, undertaken by students while learning from a resource (such as a text, a virtual environment, a tutoring system, etc.). The focus is strictly on the learners from the learners' perspective, independent of what an instructor or a system does. Thus, in differentiating active, constructive, and interactive, the framework compares and contrasts one learning activity with another learning activity during a learning phase, rather than comparing a student's activity and an instructor's activity.

A proposed taxonomy

For this taxonomy, a learning activity used in a study will be classified on the basis of a learner's overt, externally observable activities, as either active, constructive, or interactive. These overt activities are visible, can be elicited and manipulated by the instructor or designer of a learning environment, can be assessed in terms of their frequency of occurrences, and can be coded in a variety of ways and analyzed as evidence of mediators of learning.

1.1.1. Being active

Being active can be characterized as doing something (often involving physical movement) while learning. For example, in a virtual environment, if students explore the environment by steering and peddling a stationary bike while they travel through a virtual environment,

that would be considered an active activity (Tong, Marlin, & Frost, 1995). On the other hand, if students were merely watching a video recording of what the active participants saw but without being able to explore or manipulate the environment, that would be considered to be passive in that, at least overtly, the student is not doing anything.

There are numerous ways one can also elicit such engaging activities. For example, in order to make students focus their gaze on some aspects of the learning materials, one can bold the font or put the important information inside a box if the learning materials are presented in a text or animate the important information if it is presented online. In a classroom context, an instructor could point to or gesture at the important materials on the blackboard; and in math classes, teachers can provide manipulatives such as Dienes' blocks for students to use. In a virtual laboratory setting, such as a chemistry lab, students can do hands-on laboratory work using flasks, tubes, liquid, and so forth. Thus, the goal of this type of eliciting tactics is to engage the learners.

1.1.2. Being constructive

How is being constructive different from being active? There is another set of overt activities that can be characterized as more constructive because in undertaking them, learners produce some additional outputs; and such outputs often (but not always) contain new content-relevant ideas that go beyond the information given. For example, in an active type of activities such as underlining, learners are not producing additional outputs, instead, the outputs— in this case the underlined sentences, are a part of the originally presented materials. In contrast, in a constructive type of activity such as self-explaining, learners are articulating what a text sentence or a solution step means to them out loud. In so doing, learners produce utterances that have been referred to as self-explanations (Chi, Bassok, Lewis, Reimann & Glaser, 1989), and these self-explanations often contain elaborations and ideas that are not explicitly stated in the text; therefore, they go beyond the provided information. Furthermore, by articulating, the learners are also active since they are actively generating utterances visibly. Therefore, the activity of being constructive subsumes being active. Thus, in order to know whether a learner is actually generating new ideas in a constructive activity, one must analyze the content of the outputs. Constructive activities, as defined here, have two characteristics. The first, as stated above, is that they often require learners to produce some sort of overt outputs, such as explanations from self-explaining, notes from note-taking, hypotheses from inducing, questions from question-asking, predictions from generating, concept maps from drawing, self-report assertions such as ''I don't understand'' from monitoring, perhaps in the context of other utterances such as problem-solving protocols. A second characteristic of constructive activities is that they tend to ask learners to produce some outputs that are not contained in or presented in the learning materials.

1.1.3. Being interactive

Being interactive can refer to several types of overt activities, such as a learner talking with another person (who can be a peer, a teacher, a tutor, a parent), responding to a system (such as an intelligent tutoring system, an animated agent), or interacting in some other physical way involving motor movements. For example, two children can be interacting physically when they jointly build a Lego model (Azmitia, 1988), or two students are interacting physically when they coordinate their use of a mouse at a single computer monitor. The taxonomy proposed here will focus on ''dialoguing'' as the prototype of overt interacting activities. There are two dialogue patterns that do characterize interactive

activity, in the sense that both partners are making substantive contributions on the same concept or topic, and neither partner ignores each other's contributions.

1.1.3.1. Interacting with an expert in instructional dialogues: When a learner interacts with an expert (someone who knows the content domain, such as a tutor, an instructor, or a more knowledgeable peer), the dialogues tend to take an alternative well-defined pattern. The expert often starts with a question to request a response from the student, then the expert gives corrective feedback, and then there is more extended dialogue discussing the issues.

1.1.3.2. Interacting with a peer in joint dialogues: When a learner interacts with a peer, such interactions can sometimes characterize a pattern of joint dialogues, which occur when both peers make substantive contributions to the topic or concept under discussion, by building on each other's contribution, defending and arguing a position, challenging and criticizing each other on the same concept or point, asking and answering each other's questions. This kind of activity is constructive, as defined earlier, because the learners are generating knowledge that goes beyond the information given by the learning materials. The substantive contributions in joint dialogues can be made either sequentially or in a more overlapping way. In a sequential turn-taking case, each ''speaker'' takes turn after her partner finishes his/her turn. This type of learner activities in the context of joint dialogues will be referred to as ''sequential-construction.'' On the other hand, if learners build on or expand upon each other's line of reasoning by completing each other's sentences rather than waiting for the partner to finish her thoughts and ideas before interjecting, this type of learner activity in joint dialogues will be referred to as ''coconstruction.''

1.2.1. Cognitive processes underlying being active

What are the cognitive processes that may correspond to active activities? Engaging in these activities may cause a learner to activate existing knowledge, search for related knowledge, or encode, store, or assimilate knowledge that is new to the learner. These processes can be subsumed under the term "attending."

1.2.2. Processes underlying being constructive

What are the processes that may underlie being constructive in a way that generates new ideas? Constructive activities, such as self-explaining, drawing a concept map, comparing and contrasting cases, inducing hypotheses, allow the learners to infer new ideas, new insights, new conclusions, from making deductions and inductions, from reasoning analogically through comparisons, from integrating new knowledge with old knowledge, or linking information from disparate sources. Inferring new relations, new conclusions, and new insights obviously makes one's knowledge richer, and repairing one's knowledge also makes it more coherent, more accurate, and better-structured. These processes can be subsumed under the term "creating."

1.2.3 Processes underlying being interactive

Interactive activities call upon both attending and creating processes, but add a social dimension through the dialogues.

The framework generates a testable hypothesis for learning: that interactive activities are most likely to be better than constructive activities, which in turn might be better than active activities, which are better than being passive. Studies from the literature are cited to provide evidence in support of this hypothesis.