A (1)-(2)-(3) Jumpstart Approach to Answer an Open-Ended Question

ANTHONY V. DEFINA

ABSTRACT

I propose three guided questions for reflection as a jumpstart organizational formula for students with poor writing application skills to follow when responding to an open-ended question. The recipe prescribes that the student (1) understand the question design, (2) identify the intent or objective of the question, and (3) proceed to identify the key words or phrases that are relevant to answer the question. The three prompts serve as a “getting started” writing template for students to organize their thoughts and then compose the introductory sentences of their answer. The identified significant words and phrases should then be further explained and clarified by the student to complete the main body of the response. In addition, these opening sentences serve as an index at the outset of the response for a teacher to gauge the student’s understanding of and approach toward answering the question.

Key Words: Guided reflection; guided questions; introductory sentences; question’s objective; organizing skills.

The National Science Education Standards promote the use of effective communication skills for the development of scientific literacy through appropriate application of scientific terms and concepts (National Research Council, 1996, p. 22). Writing tasks are effective ways to appraise and develop science literacy because teachers can provide students with both technical and creative writing assignments (Weiss-Magasic, 2012). Moreover, Mackenzie and Gardner (2006) suggested that biology teachers should provide more expressive writing opportunities for their students to not only promote meaningful learning experiences, but also develop their writing skills. I ask students to write answers to subject-related open-ended questions that are integrated into summative assessments, review sheets, laboratory activities, and related coursework. I admit that I presume, time and again, that my secondary-level students already possess the organizing and process skills to write concisely and proficiently.

Most secondary students lack an innate ability to produce a well-organized piece of writing, and they need sufficient guidance and opportunities to build their skills (Trowbridge et al., 2000, p. 165). I find that some AP and college preparatory students, regardless of their level of content competence, demonstrate mediocre or weak organizational writing skills. In particular, their written responses unveil a need for better-thought-out introductory sentences; these opening sentences may well indicate whether the student understands the question’s objective and has the technical vocabulary to satisfy that objective. Some students with poor writing application skills compose a starting sequence of sentences that rearticulate the question over and over again in different phrases without signifying much substance toward an answer. Other students begin their response with sentences that catalog memorized definitions or bits of information without an evident connection to the question’s objective. In both situations, such students may benefit from the use of organizational guidelines that facilitate not only getting started, but also writing more informative opening sentences.

McDonald and Dominguez (2009) discuss the value of critical and reflective thinking to gain insights into what students are learning in relation to science content. Moreover, they suggest that for some students, reflections may be more successful through the use of guided questions. Such guided reflection may serve to assist students who have difficulty in sorting out their ideas and just getting those first words on paper. I employ three (1)-(2)-(3) guided questions to jumpstart the first sentences of a student’s written response and serve as a gauge of how prepared he or she is to formulate a “satisfactory” answer. I ask my students to think about (1) what does the question present; (2) what is the intent or objective of the question — what is it “really” asking; and (3) what key words or phrases are relevant and looked-for to answer the question. These prompts serve as useful organizers, especially because open-ended questions can be challenging in their scope and depth.

The student should first (1) identify the nature of the question — what the question presents or introduces; and second (2) reflect upon the intent or objective of the question — what the question is testing. Some open-ended questions are relatively uncomplicated in their design, (2) identify the intent or objective of the question, and (3) proceed to identify the key words or phrases that are relevant to answer the question. The three prompts serve as a “getting started” writing template for students to organize their thoughts and then compose the introductory sentences of their answer. The identified significant words and phrases should then be further explained and clarified by the student to complete the main body of the response. In addition, these opening sentences serve as an index at the outset of the response for a teacher to gauge the student’s understanding of and approach toward answering the question.

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design and have the straightforward purpose of appraising a student’s ability to apply specific subject matter. For example, the question may present a biological concept or process such as natural selection and expect students to be able to describe and explain the concept or process further in an example, such as a case study of the peppered moth. Similarly, other question types and aims might include a question that talks about field or laboratory observations for student interpretation, a question that reports experimental data for students to draw conclusions, or a question that introduces a list of terms for students to correlate and interconnect. On the other hand, there are open-ended questions by design that are not so clear-cut and may weave a crafty “clue” or “hint” that points toward a specific point of information or a particular understanding to be uncovered by the student. As a case in point, a question that presents a scenario about the rate of glucose consumption and ATP production by yeast cells in an environment with unpredictable oxygen levels is almost certainly targeting knowledge about facultative anaerobes that can switch between fermentation and aerobic respiration. Another question that illustrates graphical data of the rate of CO$_2$ uptake at night versus daytime by different plants in an arid habitat is likely probing for an awareness of the adaptive stomate functions and alternative pathways for carbon dioxide fixation that are characteristic of C4 and CAM plants. In the same way, a question that stages a comparative setting between a forest area clear cut by a timber company and one covered over with lava after a volcanic eruption is, in all probability, testing a student’s ability to recognize conditions that differentiate between primary and secondary ecological succession.

Third (3), the student should identify significant terms and phrases that are applicable to the question’s objective and should be incorporated into the ensuing response. For example, a question that calls for a description of DNA replication should have key words in the response that include semiconservative mechanism, origin of replication, leading strand, lagging strand, and relevant enzymes such as helicase and DNA polymerase, these are some of the terms I would check for in the student’s answer. Similarly, a response to a question about mechanisms that regulate population growth would be lacking without important phrases such as density dependent and independent factors, logistic growth model, and carrying capacity. Moreover, a question about neuronal communication should involve an answer with basic terminology such as axons, dendrites, ion channels, depolarization, repolarization, sodium-potassium pump, and neurotransmitters. After relevant and significant vocabulary words are noted, the student should then proceed to clarify, explain, incorporate, and integrate these terms and phrases to form a completed answer.

The described (1)-(2)-(3) jumpstart approach is not a formula to transform a student who lacks study preparation into a student who has the facts at hand to answer the question, but rather it is a guided prescription to assist students with deficient writing-process skills to get started on their answer with a more “informational” introduction. In Figure 1, a student whose response exemplifies poor application introduces his or her answer by shuffling or restating the words from the open-ended question itself. There is no direct indication in the opening sentences whether the student understands the objective or has the basic terminology expected in the response. On the other hand, the student with improved application from the guided approach demonstrates a more straightforward introduction that establishes, at the outset, that the student understands the question’s goal and has the terminology to write a successful answer.

Similarly, in Figure 2, another student whose response demonstrates poor application does not confirm, up front, that he or she “gets” what the question is asking and describes organelles without bringing in the concept of interaction. The student following the jumpstart guideline creates a more tell-tale introduction that states the aim, and notes particular organelles that interact with reference to a named cellular process; these opening lines are useful as indicators of the student’s “direction” toward finishing the answer. Note that the focus of the proposed strategy is writing well-organized introductory

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**Open-ended Question no. 1**

Reptiles, birds, and mammals are vertebrates whose embryos develop in an amnion and are functionally and structurally supported by other extra-embryonic membranes. Compare and contrast these membranes in a typical bird embryo and a typical mammalian embryo.

**Introductory Sentences:**

**Poor Student Application**

“In a typical mammalian embryo the membranes support the embryo, which is in the amnion. The membranes also support the embryo in a bird egg where the embryo is also in an amnion. These extra-embryonic membranes provide different functions to help the embryos develop in the birds and the mammals.”

**Improved Student Application with (1)-(2)-(3) Guided Reflection**

“The question presents a statement that birds and mammals are amniotes whose embryos are supported by extra-embryonic membranes. The purpose of the question is to compare the function and structure of extra-embryonic membranes in typical bird and mammal embryos. Key words or phrases include chorion, allantois, yolk sac, amnion, placenta, and umbilical cord.”

**Figure 1.** An open-ended question, a student’s response that exemplifies poor writing application skills, and the improved version.

**Open-ended Question no. 2**

Interactions within biological systems lead to complex properties. Explain this concept in relation to the statement that the structure and function of subcellular components, and their interactions, provide essential cellular processes.

**Introductory Sentences:**

**Poor Student Application**

“The cell is made up of a number of different parts called organelles. There are mitochondria which give energy. The ribosomes are involved in making proteins and a vacuole stores wastes and food. There are a number of other organelles that function in the cell.”

**Improved Student Application with (1)-(2)-(3) Guided Reflection**

“The question presents a concept and point of knowledge that cellular processes have complex properties that result from interactions of subcellular components. The intent of the question is to describe how subcellular components interact to provide a complex cellular process such as secretion of a protein product. Key words that apply are organelles, secretion, enzymes, hormones, ribosomes, endoplasmic reticulum, Golgi complex, vesicle, and plasma membrane.”

**Figure 2.** An open-ended question, a student’s response that exemplifies poor writing application skills, and the improved version.
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**Figure 3.** Scoring rubric.

As previously noted, the opening sentences of the response can be useful for the teacher as a preliminary assessment of the student’s preparation, mindset, and writing application skills. The organizational layout also provides a framework that may be incorporated into a simple 15-point scoring rubric (Figure 3). The initial sentences of the response point out whether the student understands the question, identifies the target of the question, and has the content knowledge necessary for an acceptable answer. The proper use of that content information determines the accuracy, completeness, and acceptability of the response’s core or main text.

The (1)-(2)-(3) guided questions provide an introductory blueprint and may operate as a coordinating tool for students to compose more instructive and revealing opening sentences in their written response. Moreover, the reflective prompts may promote improved writing practice for students with poor application skills and for students who may need a “jump” to get started on writing that answer.

**References**


**Anthony V. DeFina** is a former Science Department Supervisor and is currently a full-time teacher of AP Biology, Anatomy & Physiology, and Environmental Science at Wayne Hills High School, 272 Berdan Ave., Wayne, NJ 07470. E-mail: adefina@wayneschools.com.