AMERICAN SOCIETY FOR MICROBIOLOGY

BiologyScholars.org
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# 2013 Biology Scholars Program

# Post-Institute Homework Assignment #4

# Tutorial Response: Publishing Curriculum Articles

*Assigned: November 7, 2013*

*Due Date: November 18, 2013*

**ASSIGNMENT INSTRUCTIONS**

Your fourth assignment is to watch the tutorial "An insider's guide to publishing *Journal of Microbiology & Biology Education (JMBE)* curriculum articles," hosted by Jean A. Cardinale, Alfred University and Curriculum Editor, *JMBE* and then respond to the prompts below. This tutorial is designed to:

- Give an overview of the *JMBE* and the Curriculum section
- Show examples of Curriculum submissions
- Provide tips for success

1. Watch the tutorial: "An insider's guide to publishing *Journal of Microbiology & Biology Education (JMBE)* curriculum articles" (approx. 47 minutes of presentation and 8 minutes of Q&A).

2. Describe an activity you could submit to *JMBE*'s Curriculum section and draft 3-5 learning objectives related to that activity. Enter your responses in the Google form.

This and all other post-Institute assignments are posted on the Wiki (http://wiki.biologyscholars.org/1Assessment_Residency/2013_Assessment_Cohort/Assignments/Post-Institute_Assignments).

# Describe an activity you could submit to JMBE's Curriculum section (limit 300 words).

**Lee Abrahamsen and Stephanie Richards:**

Understanding protein structure/function

Three parts:

1) Building model proteins from pipecleaners

Students work in small groups. Each student is given a color-coded pipecleaner (color corresponds to a secondary structure or chemical property within the protein.) Students are instructed to generate a primary structure, then secondary structures and finally tertiary structures that are consistent with the properties assigned to each colored pipecleaner. Groups then compare structures at the tertiary level and then combine their models to generate quaternary structures.

2) Comparing proteins within a family

Students are asked to work in groups to generate an on-line information document for a specific assigned protease. Once the documents are generated, students can look at all of them. Students are then asked to write a take-home essay comparing and contrasting structural and functional characteristics of two of the proteases. The essays are done individually, and are handed in as part of the first exam.

3) Amino Acid sequence alignment of proteases

Students are guided through an on-line tutorial (either as a lab exercise or an assignment) to search the NCBI for the amino acid sequences of the proteases they wrote about. They are asked to align the sequences and look for similarities and differences in domain structure of their proteins.

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**Megan Howard:**

After listening to the webinar, I have a couple idea's - I'm not sure whether they have been already done (more opportunities for literature reading!).

* Teaching via Investigation: Investigative projects as a means to teach Introductory Microbiology for majors

—> Probably a research article

* Differentiating the Enterobacteriaceae: An active learning method to teach classical metabolic tests in a non-majors Microbiology lab.

* Dichotomous keys and student-driven unknown projects in Allied Health Microbiology

* Improving concept retention and understanding in Allied Health Microbiology Lab using Case Studies

* Teaching aseptic technique and isolation using cases

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**Jerry Kavouras:**

Activity: Workbook

The purpose of the activity is to demonstrate that students can (1) apply concepts from the course and (2) communicate science to an audience.

Students will work in groups to create a workbook that highlights major scientific principles related to ecology and the environment.The workbooks should be informative, fun, and creative. The target audience is students in grades 5-8. The workbooks must have at least eight activities (e.g., crossword puzzles, connect-the-dots, etc.). The workbook should have a general theme(s), e.g., mutualism, competition, food webs, biomes, population growth dynamics, etc. that is integrated throughout the exercises. Think about the workbooks or exercises that you enjoyed, or found useful, as a student in grade school when designing the workbook.

Students will be assigned the activity in week 4.

Students will declare a theme for the workbook by week 10.

The final product will be presented to the class in week 16.

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**Joan Kiely:**

The activity engages students in authentic research by having them perform immunoblots using L929 lysates and a panel of commercially available antibodies. This was authentic research because most of these antibodies had not been tested on mouse cells. The students then compared the results for their antibody to their classmates' results with different antibodies.

This activity had several parts. In the first step the students worked in groups of three to lyse cells and measure the protein concentration. The students graphed this data and made their calculations using a standard curve.

In the next step the same groups ran SDS-PAGE electrophoresis gels and electrotransferred the proteins to membranes.  The students confirmed that the transfer was successful by staining the membrane.

In the next step the students treated the membranes with a variety of antibodies.  All the antibodies were directed against proteins important to our course.  One antibody was common to all groups to stress the importance of controls.  The data from this portion was collected by chemiluminescence.

Finally each group analyzed their results considering: the amount of protein loaded and the intensity of the chemiluminescent signal.

We then rearranged the class into three review teams; each team had one person from each lab group. The teams compared their results from the protein concentration assays, the control antibody and the test antibody.  Each person was responsible for explaining the function of their target protein to the review team.  Each review team was tasked with deciding which antibodies "worked" and which did not. Each individual student wrote a short summary of their conclusions about the antibody panel.

The activity had three formative assessments: graphing the protein data, a problem-based activity on immunoblotting and the peer presentation.  The final assessment included the written summary and later laboratory reports.

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**Crystal McAlvin:**

I use many group activities and active learning (mostly via clicker since my classes are 250+). I am thinking though of an activity that I have students do where they look up an article or advertisement (on web or in a popular science magazine) that is making some kind of health claim. It could be weight loss or anything health related. Then I have them investigate the validity of the claim. Is there evidence of the scientific method in the article? Is there links to peer reviewed research? OR is the evidence anecdotal? If there is/are links to peer reviewed research, I have them follow the links and look at the methodology behind the experiment. If there is no links, I ask them what kind of evidence would they like to see to increase their confidence in the claim?

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**Sally Molloy:**

I am at a loss to coming up with a particular activity for publishing. If I ask myself what component of the course that I am working on is unique it is the way I have for a particular unit of the course linked content with a learning habit (skill).  The students learn the content by demonstrating a particular learning habits through completion of a written activity. The classroom experience involves a formative assessment of students' understanding of the content and learning habitat at the beginning of class, followed by an interactive discussion/lecture where I demonstrate, with input from the students how to solve the content problem using the learning habit. The students then complete the a written activity that involves applying knowledge from a reading assignment with the goal of mastering the content through application of the learning habit and content to difficult problems. The students then complete a reflection assignment, reflecting on the content that they learned through problem solving and on the effectiveness of the strategy they used to solve the problem.

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**Maura Pavao:**

I started using Mudwatt's in my Biotechnology course. They are designed for students to use soil microbes to generate electricity. Students can design experiments to increase the output of electricity.They also identify the microbes involved by culturing aerobes and anaerobes and identify using a Biolog identifier.  This could be adapted for a Microbiology class to demonstrate anaerobic respiration.

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**Anne Rosenwald:**

We're in the process of revising our Biochemistry class.  One thing I'm going to do is revise the Bioinformatics lab that is part of this course - the old lab is kind of a "hunt and find" series of questions to address (look on this web page for the answer to this particular Q), but I'm hoping to make this more learner directed.

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**Didem Vardar Ulu:**

Due to its interdiciplinary and rapidly advancing nature, biochemistry courses demand constant updates on instructional material that can effectively cover a broad range of content in the limited amount of class and develop a wide range of skills. For the past few years now, I have developed a multiweek activity for my biochemistry courses that gives responsibility and ownership to the students to address these concerns and become successful independent learners. I have implemented it both as a stand alone activity in my upper level course, as well as a sub-module of a bigger final group project in my introductory course.  I believe it effectively streamlines the exemplifiation and application of multiple competencies across several content items using student created instructional material as a part of the student centered learning environment.

In this guided activity, the students study current primary literature to identify and independently learn the pertinent underlying molecular and structural biochemical content that is required to explain a functioning macroassembly of their choice.  This learning process culminates in a write-up of a specific question derived from the studied primary literature with a detailed answer key that could be used to assess another student's understanding of a particular biochemical concept.  The question needs to contain sufficient information from the specific section of the primary literature it was based on to enable other students answer it without having to read the entire paper.  As a part of the activity these questions and answers are circulated among the other group members for peer review before being distributed to the rest of the class or other course sections as study materials. This activity proved to be a quick and effective way of generating ample high quality, up-to date study materials that reflected current students' interests and help them become successful independent learners.

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**Matthew Waterman:**

Chapter Study Guide Construction via Jigsaw Group Activity

Before class

- Prior to class, students watch lecture capture/video and individually submit list of at least 3 (no more than 5) main topics/concepts in the chapter (include page number if found in text). Submission is done individually online. [30 – 60 min]

First class session [45 min total]

- Students work in groups to merge their personal lists into a group list of 3-5 main topics/concepts [10 min]
  - Once group list is complete they write it on the board
- With the class as a whole, collectively merge group lists into a class list of 3-5 main topics/concepts [10 min]
  - Divide concepts and assign one to each group
- Groups compile list of 5-10 important terms and definitions related to topic/concept and write them in own words (include page number) [15 min]
  - Can be used to make flash cards as an optional activity
  - Term list is turned in online by end of class
- Groups choose at least one format (examples below) for organizing their assigned topic/concept and begin preparing their mini-guide [10 min]
  - Comparison chart or table to compare and contrast groups of ideas
  - Concept map to connect related ideas
  - Diagram or cartoon for dynamic processes
  - Flowchart for procedures and experiments
  - Timeline for a series of events over time

After class

- Out-of-class, students refine the mini-guide and submit draft online. [30 – 60 min]

Second class session [60 min total]

- Students meet with their groups to finalize their mini-guide and prepare to explain it to others as “experts” [15 min]

- Combine “experts” from different groups to form new groups, each expert explains their mini-guide to other members of the group and they discuss/revise. Expert brings this discussion/revision back to original group. [15 min]

- Back in the original group students update their mini-guide. Then students work together to write 1 constructed question and 1 objective question (examples below) that could show up on the test and create an answer key. Groups present their questions to the class. [25 min]

o CONSTRUCTED

- Short answer

- Problem solving/data interpretation

o OBJECTIVE

- True/False – if answer is false explain why

- Multiple choice

- At the end of class turn in final group mini-guide and two questions (online). [5 min]

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**Maureen Whitehurst:**

My college library provides 'LibGuides' for various courses. I use a LibGuide for BIO 225L, Microbiology Laboratory. The website is:

http://libguides.tridenttech.edu/bio225

I use an 'Unknown Organism' LibGuide quiz to orient students to the Unknown Organism exercise.

The 'Unknown Organism' LibGuide provides guidance regarding drafting 'The Unknown Organism' laboratory report. Students identify an organism at the end of the semester by performing various biochemical tests and submit a written laboratory report consisting of typical sections such as purpose, methods & materials, results, discussion, conclusion, references. LibGuide sections include links to online image databases, reference section citation format, report format, rough data sheets for use during laboratory sessions, instructions for use of the Bergey's manual.

This curriculum exercise would discuss use of the Library-provided LibGuide by microbiology lab students.

The Unknown Organism exercise commenced last week for two of my lab sections. About 30 students will complete this exercise this term. I will have the scores on the LibGuide quiz and the scores earned on the written reports. I can find out if completion of the LibGuide quiz contributes to written lab report success by checking if students include appropriate reference citations and suitable database images.

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# Draft 3-5 learning objectives for this activity, and identify possible tools that you could use to provide evidence of student learning across these objectives.

**Lee Abrahamsen and Stephanie Richards:**

Students will be able to describe the primary, secondary, tertiary and quaternary structure of proteins in general.

Students will be able to compare the structures and functions of proteins within a family.

Students will be able to search databases for sequence information and align and compare structural regions.

Student Learning:

Pre and post activity clicker questions (individual and group)

Exam questions (take-home and in class)

Completion of web-based exercises

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**Megan Howard:**

I chose one of the above to write out a few learning objectives:

* Differentiating the Enterobacteriaceae: An active learning method to teach classical metabolic tests in a non-majors Microbiology lab.

LO's ->

* Describe the main purpose of the IMViC, PR-Sugar panel and related tests in Diagnostic Microbiology.

* Use metabolic tests and Biochemical test tables to identify Gram negative bacilli.

* Construct a Dichotomous Key using Biochemical tables and results that can be used to differentiate a select group of the Enterobacteriaceae.

* Demonstrate knowledge of classical microbiology methods and microbial identification.

* Describe the medical importance of the Enterobacteriaceae.

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**<u>Jerry Kavouras:</u>**

Learning Objectives:

Upon successful completion of this activity, students should be able to:

1. identify ecological principles and related topics

2. describe (define) ecological principles and related topics

3. apply ecological principles and related topics

4. create grade school learning exercises that integrate the ecological principles and related topics

The final product will be evaluated using a rubric. The criteria are: organization, content/relevance, accuracy, visual presentation, and writing mechanics.

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**<u>Joan Kiely:</u>**

Learning Objectives:

1. Students will gain experience presenting their results orally to peers.
2. Students will evaluate the presentations of peers
3. Students will evaluate data produced by their peers
4. Students will create and interpret a graph of a protein assay measuring concentration
5. Students will be able to describe the following techniques
    a. Cell lysis using detergents
    b. Bio-Rad protein assay
    c. SDS PAGE
    d. Immunoblotting
6. Students will identify limitations of their own and peer data sets
7. Students will identify on-line resources for information on cell lines and antibodies.

Assessment:

1. Graphing of protein assay data and calculations

2. “The Incompetent Biologist” problem set

3. Peer evaluations of presentations

4. Summary paper of class results, which will include paragraphs describing which antibody worked “the best,” evidence for their conclusion and a review of the functions of the target protein.

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**Crystal McAlvin:**

1. Students will increase their proficiency in scientific literacy.

2. Students will be able to discern between science and pseudoscience.

3. Students will analyze a scientific article for its validity.

4. Students will describe an experiment and its anatomy.

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**Sally Molloy:**

The following are specific learning objectives for a written activity I teach on lambda biology. Included in the objectives are content learning objectives, a new learning habit objective, and previous learning habits that I expect students to continue to practice while completing the activity.

1. Understand the biology of Lambda phage.
    - Be able to illustrate the basic structure of lambda genome.
    - Be able to identify both forward and reverse oriented genes.
    - Understand the function of operators and repressor proteins.
    - Understand the relationship of operators, repressors and lytic versus lysogenic gene expression.
    - Understand the role of repressor proteins in superinfection immunity.
    - Understand bacteriophage integration systems.
2. Be able to apply past knowledge to new situations or problems.
    - a. Demonstrate the ability to abstract new meaning from a past learning experience and apply it to a new challenge.
    - b. Be able to pose new questions upon incorporation of new information to past knowledge.

3. Continue practice of generating a plan or strategy before tackling a task/problem and persisting in the face of challenge/failure.

4. Continue to practice working effectively and collaboratively in a group.

5. Continue to strive for accuracy and maximum effort.

Assessment tools - I use warm up quizzes in the beginning of the class period and the written activities to formatively assess content. Quizzes serve as summative assessment of content which are taken first by individuals and then as a group. The groups contain the same students for the entire semester. I assess learning habits in the written activity and in the weekly reflection assignments. In a sense, the quizzes also serve to assess learning habits since they require application of past knowledge to a new situation, sometimes require application of a particular learning strategy such as as use of thinking maps to present a concept. And because they are taken first as individuals and then as groups, the students are required to use interdependent thinking in order to improve their over all quiz score. I grade individual quizzes first, calculate the average individual score for each group. If a group's grades is higher than the average individual grade, I add the difference between the group grade and the average individual grade to each individual grade.

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**Maura Pavao:**

1. Communicate and analyze laboratory data in the form of a written report with statistical analysis. (rubric for lab report)

2. Apply the scientific method to experimental design (rubric for lab report)

3. Identify an unknown organism using biochemical assays (Biolog)

4. Relate microbial electron transport to electricity, Ohm's law and reduction-oxidation reactions (exam questions, pre- and post-testing, questions on the exit exam for graduating seniors).

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**Anne Rosenwald:**

1. Demonstrate facility with online bioinformatics tools

2. Identify biological information associated with a particular DNA sequence (an open-reading frame); be able to determine whether this information is as a result of bioinformatics investigations only or whether this is as a result of bench experimentation.

3. Investigate the extent to which this sequence is conserved among closely related organisms; be able to describe what this means for evolutionary conservation.

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**Didem Vardar Ulu:**

Learning Objectives:

At the completion of the activity the students will be able to:

1. Find, analyze, discuss, and evaluate scientific content in a primary literature that addresses a biochemical problem or claim

2. Communicate biochemical concepts to others with similar background (peers) in writing, using discipline appropriate jargon and representation

3. Propose a biochemically plausible explanation to how a variety of biomolecules perform their biological function by contextualizing their specific structural features when provided their structures and functions

Evidence of student learning/ achievement of objective:

1. The materials students use and the discussions they provide as a part of their laboratory reports

2. The answers students give to open ended essay questions in the exams that incorporate passages from primary literature as a part of the question.

3. Exam questions that require students to explain the underlying biochemical principles for a functional biomolecule using molecular and structural details to justify their answers.

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**Matthew Waterman:**

The 6 numbered objectives are main objectives that are carried through for the entire course. The lettered sub-objectives are for the specific topic of the week. The example I included below is for a unit on transcription & translation.

1. Explain how a cell functions at the molecular level
   a. Explain the general process of gene transcription
   b. Compare and contrast transcription in eukaryotes and prokaryotes
   c. Explain the structural and functional significance of RNA processing
   d. Describe the process of RNA splicing
   e. Explain the role of energy in RNA translation
   f. Explain the structural and functional involvement of ribosomes in RNA translation
   g. Describe the steps involved in RNA translation

h. Explain the function of post-translational modification of proteins

2. Explain how scientists study cells at the molecular level

a. Explain how DNase protection can be used to identify promoter regions of genes

b. Explain how consensus sequences are used to define promoter regions of genes

3. Interpret and explain cell biology and genetics research results

a. Label and/or explain an electron micrograph of translation in action

b. Determine the consensus sequence for a promoter element

4. Organize information from lectures and readings into a study guide

a. Create a mini study guide for a concept in the chapter

5. Create practice assessment questions related to course content

a. Create an objective and a constructed question for a concept in the chapter

6. Work successfully in a small group/team environment

The tools I could use to provide evidence of student learning would be quiz and exam results, samples of student constructed mini-guides, and samples of student generated questions.

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**Maureen Whitehurst:**

1) Students will select an appropriate image from an online image database such as the CDC Public Health Image Database or ASM Microbe Library digital resource for inclusion in the written Unknown Organism lab report. I will record the image information for digital resources included in final laboratory reports and evaluate suitability of such illustrations.

2) Students will utilize correct citation format in their written report. The LibGuide includes appropriate guidance and a suitable question is included in the LibGuide quiz.

3) Students will make appropriate use of the Bergey's manual in the Unknown Organism Discussion section. The LibGuide includes an instruction sheet for use of the Bergey's manual.

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# Do you have any questions for Jean Cardinale, Curriculum Editor?

**Megan Howard:**

Nothing specifically at the moment, although I have been working on several different inquiry-based approaches for both the Allied health and the majors Investigative Microbiology laborsatories, and will be developing a project-driven course to mirror investigative research (and adapting several protocols for it) that I think would be good curriculum articles this coming semester (for example, using 16S FISH to teach microbial diversity in an investigative lab context) and I wasn't sure how to determine whether these are novel, and useful to publish - or not since they will be adapted from current research articles… Any advice would be very helpful!

Thanks for the great webinar - very encouraging!

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**Jerry Kavouras:**

Not at this time. Thank you.

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**Crystal McAlvin:**

Not currently :)

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**Sally Molloy:**

While some of my activities might be worth publishing, I was wondering if my entire Phage Genomics Curriculum, which actually involves integrating all of the above with the laboratory experiments of the HHMI-SEA PHAGES course, would be worth publishing? My thought is that there are new Colleges teaching this course every year and the course might serve as a model for other SEA-PHAGES courses and for other laboratory courses that are based on fundamental research in the classroom.

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**Maura Pavao:**

Measuring student learning is difficult except through pre- and post-testing. It doesn't really measure whether this exercise is better than others used since no assessment has been done with the other exercises. Is pre- and post testing enough? The alternative is to use it in Microbiology and have day students do the exercise and night students do something else and see if there is a difference.

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**Anne Rosenwald:**

Hi Jean - nice webinar!

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**Didem Vardar Ulu:**

Thank you Jean for taking us through the curriculum article category and submission to JMBE. I also teach small classes and almost necver repeat one activity exactly the same way, but try to make it better or more effective with each iteration. After attending the Research and Assessment Residencies I had pretty much decided that none of those activities I had developed with clear learning objectives *which I believed were quite successfully achieved with the activity) could be published because I do not have the traditional assessment data (and basically can never get to a statistically analyzable number). The webinar showed me that perhaps this dilemma is exactly what the curricular articles are trying to address, so I am really considering writing up the above mentioned activity and sending it in. I am sure I will have additional questions as I start putting it together, but for now I have one specific question. As I hope is clear from the short description I provided above, one of the most novel aspects of this activity (I think) is that it not only fulfills important student learning objectives but also simultaneously addresses some important challenges for the professor helping the professor become more efficient in his/her teaching. What is the best way to incorporate this aspect of the activity to the paper (it is not quite a learning objective and I am not sure what is the best way to demonstrate that the goal is achieved other than myself saying that it really helped me to create a wonderful self-updating question bank that I can use for upcoming semester. I would welcome any suggestions.

Thanks,

Didem

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**Matthew Waterman:**

Is this activity novel enough for submission to JMBE? It basically combines tried and true methods of concept mapping with a group jigsaw format.

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**Maureen Whitehurst:**

My college is adopting a 'compressed' seven week schedule in the Fall 2014 semester. This change is 'compression' because the current Fall/Spring semesters are 14 weeks in duration. I saw the recent scope expansion announcement and wonder if the compression plans are appropriate for the new scope? The semester 'compression' is expected to improve student interest, motivation, retention, and success, and also is quite an institutional transformation. I would like to analyze some aspect of our compression process concerning microbiology students. Do you see a match for my local 'compression' situation and the scope expansion?

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