

Minute Paper

This is a short, in-class writing activity prompted by a task or question posed by the instructor. It encourages participants to reflect on the content and to provide the instructor with immediate feedback on the quality of the teaching and learning. The activity takes 2-5 minutes.

Initially developed by a physics teacher to oblige his students to attend lectures, he became more interested in the information it provided about the effectiveness of his teaching each day.¹ It has been shown that students retain almost twice as much content, both concrete and conceptual, when they prepare a short summary at the end of each class.²

- Minute papers can be used at the beginning, in the middle or at the conclusion of a class.
- Pose specific questions or tasks (unclear questions produce unclear responses).
- Ask participants to take a minute and half sheet of paper to record their responses.
- Clarify that the Minute Papers are a feedback tool and do not count toward their grade.
- Consider your objectives for the task and explicitly state the desired format (key words, calculation, complete paragraph...).
- Analyze the results immediately after class, as you are unlikely to do it later.

Ressources

1. Dr. Schwartz, 1977, University of California (Berkeley).
2. Menges, R. 1988, Research on teaching and learning, Review of Higher Education, 11, 259- 268.
3. Angelo T.A. & Cross, K.P., 1993, Classroom assessment techniques, Jossey-Basse.

Think, Pair, Share

This strategy provides students with the opportunity to share or compare their ideas, solutions or questions with another student. Research tells us that we need time to mentally "digest" new ideas in order to store them in memory. When teachers present too much information all at once, much of that information is lost.

Rather than using a basic recitation method in which a teacher poses a question and one student offers a response, Think-Pair-Share encourages a high degree of student response by allowing students to compare and check their answers. When students talk over new ideas, they are forced to make sense of those new ideas in terms of their prior knowledge. Their misunderstandings about the topic are often revealed (and resolved) during this discussion stage. The collaborative approach may also enable students to solve more difficult questions than they can alone.

- Announce a discussion topic or problem to solve. (Example: What are the functional differences between plant and animal cells?)
- Give students at least 10 seconds of think time to THINK of their own answer.
- Ask students to PAIR with the person sitting next to them to discuss the topic or solution.
- Finally, randomly call on a few students to SHARE their ideas with the class.
- Give students time cues for each step will keep them on task.
- You can promote discussion by using slightly different tasks for each stage, such as asking 'What are the functional differences between plant and animal cells?' or the THINK step, then asking 'What is the most significant functional difference between plant and animals cells?' for the PAIR stage.

Source: Peter White + <http://olc.spsd.sk.ca/DE/PD/instr/strats/think/index.html>

Quescussion

This type of discussion is conducted entirely in the form of questions, which eliminates student concerns about providing 'wrong answers'. It has proved useful in a variety of subjects, especially controversial ones, and works across a wide range of class sizes. Used to open a topic, it can encourage students to recall relevant information and let the instructor know what students already know. As a concluding activity, it offers an opportunity to integrate and connect the new knowledge.

- Formulating a good question, which targets the desired concept but doesn't have a clear answer, is essential but often quite challenging.
- Be sure to take time to explain the rules:
 - All contributions must be in the form of a question.
 - Participants must wait until x other people have spoken before they can speak again.
 - No statements in the form of questions ("All professors wear ugly socks, don't they?")
- Classes have to learn how to do quesussions: expect some silence and don't succumb to the temptation to end the activity too quickly. The first tentative questions often prompt a flurry of others.
- The activity rarely lasts more than 10 minutes and is often shorter.

Examples:

How much energy is required to boil a pot of water?
Can my friend Yvette vote in the next election?
Should the Canadian Armed Forces continue their mission in Afghanistan?

Source: Peter White + http://www.uwo.ca/tsc/tlc/lc_part3c.html

Gallery walk, Graffiti, Bus stop

These activities involve small groups of students working in a particular location on a particular task, and then rotating to the next station. The task may be prompted by a question, image, case study, or a numeric problem.

When choosing which strategy to use, remember that while changing groups can stimulate more discussion, it also requires significantly more time as students must renegotiate group dynamics.






Gallery walk: Students use the material provided at each station to enrich their individual productions. Students are generally free to determine the order and time allocated to each station.






Graffiti: Students review the material provided at each station, and adding their own contributions directly on the poster/image/etc. Students may travel independently, or be asked to circulate with a stable group.

Bus stop: Travelling with their 'tour group', students circulate between the different stations to develop their collaborative production.

- Ensure that students are clear about what they need to accomplish before they start moving around.
- These time consuming activities require challenging learning objectives and stimulating information at each station to feel valuable to students.
- Provide clear time cues, and circulate to check on students' progress.
- If students are setting their own itineraries, establish rules about how many people can be at a given station at once.
- To promote collaborative work, use large format of productions (ie A3 sheets and markers).
- Have a plan for how to wrap up and exploit students' productions.

Example Questions for Active Teaching Strategies

| Subject Area Strategy | Biology P. White, A. Heppleston | Chemistry S. Isaac | Math N. Sonnerat | Computer Science S. Stolpner |
|---|---|---|--|--|
| <u>Brainstorming</u> Issues  | Biological diversity shows a strong correlation with temperature. Assuming that this relationship is not causal, what else could cause this pattern? | What should be included in today's the lab report? Which items are the most important? | What properties can curves in three-dimensional space have? How would you describe those properties mathematically? | How to efficiently compute the Convex Hull of a point set in the plane? |
| <u>Buzz Group</u> Discussion Material  | What kind of testable hypotheses would result in evidence for/against evolution? | Which of the following substituents will have the greatest effect on the aromaticity? Cl, NO ₂ , OH. | What obstacles are there to a function having a Taylor series expansion about a certain point? | What are the problems that are easily solved by humans, but not by computers? Why? |
| <u>Quescussion</u> Sequences  | Are species affected by habitat fragmentation? ...What are the target species? ...How big are the fragments? ...What is the degree of fragment connectivity? | What is the final temperature when 1.6 kJ of energy is added to a solution? ...What is the initial temp? ...Heat capacity? ...Volume of solution? ...Will there be a change of state? | What is the maximum of $f = \sin(cx^2)e^y$? ...What is c (constant or variable)? ...What's the domain of f? ...Are we looking for a local or global maximum? | What is the meaning of $f(n) = O(g(n))$? ...What are the restrictions on n? ...When is such a relationship useful? What are its limitations? |
| <u>Think Pair Share</u> Questions  | You are looking at an unlabelled cell under a microscope, what cell structures would you look for to aid identification? | Think – What are the 3 most important concepts from today's class? Pair – Give your partner a brief synopsis of 1 key concept. | What is the limit of the given sequence? | What is the order in which nodes are explored in this graph using A* search? |
| <u>Minute Paper</u>  | What relationship did you see between today's topic and other topics previously covered in this course? | What is temperature, from a molecular perspective? | Calculate the global maximum of the following function: | Would you agree or disagree with this statement: . . .? Why? |

| Strategy \ Subject Area | Physics | Psychology | Agriculture | Health Science |
|---|--|--|---|---|
| | M. El Ouali | C.Holly, S. Huntgeburth | T. Eades | S. Isaac |
| Brainstorming Issues  | How can I measure the mass of an electron? | What constitutes mental illness? | What are some reasons for using and promoting greenroofing? | What are the main causes of pulmonary disease? |
| Buzz Group Discussion Material  | How do we know that planets are not being pushed along their orbits by angels? | Should medications be used to treat depression? | How much and what type of involvement should the government have in regulating GMOs? | How should hospital admittance triage be optimized in a swine flu outbreak? |
| Quescussion Sequences  | What is the best source of energy? ...What is it to be used for? ...Are there environmental considerations? ...What are the fluctuations in the demand? | What is the best way to treat mental illness? ...What is mental illness? ...Can mental illness be treated? ...What kinds of treatments are appropriate? | Are crops affected by tilling? ... Affected how? ... Are effects different in the short and long term? ... What environmental factors are significant? | Should a female patient be prescribed the drug X for a heart condition? ... Is the patient pregnant or lactating? ... Does the patient smoke? ... Is obesity an issue? |
| Think Pair Share Questions  | Think – draw a picture of mud flying off a quickly spinning bike wheel. Pair – describe the forces that make this occur. | Why, in a pair of twins, can one develop mental illness and not the other? | Name several features you can use to distinguish the Rosaceae from the Ranunculaceae. | Think – describe the blood clotting cascade. Pair – What would be the phenotype of mutation Y present? |
| Minute Paper  | What happens to the electrons that create the current when a switch in the circuit is opened? | How does the theory of sexual selection influence short-term and long-term selection behaviour? | What are the main management challenges in the National Parks system? | Outline the progression of a listeriosis infection in an otherwise healthy adolescent. |