**Indian Institute of Technology Bombay**

**IDP in Educational Technology**

*Instructor Resources*

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| Resource – *Think-Pair-Share Activity constructor* | Version 1.0, Dec 2013 |
| Download from: [www.et.iitb.ac.in/TeachingStrategies.html](http://www.et.iitb.ac.in/TeachingStrategies.html) | Released under: Creative Commons-Attribution 4.0 license |

**Part 1 – Plan your TPS activity**

1. States of Matter (Choose a topic from your current/next course that has scope for multiple solution approaches, or detailing of an abstract concept, or some form of *open-ended discussion.* See Appendix for some examples.
2. **Think phase**: Write an initial (seed) question on the problem or topic you want to discuss.

*Example from cs101*: “Write the pseudo-code to find the smallest element in an integer array”.

*Ensure that*: (i) The question is broad enough so that most students in your class can write some response. (ii) A student can think about it and write an individual answer in about 1-3 minutes. (iii) There is a clear deliverable for the student.

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| WriW What is matter ? What are various states of matter ? |

1. **Pair phase**: Write a follow-up question, that two students can work on together.

*Example from cs101*: “Identify missing pieces in each other’s pseudo-code. Together, build on your pseudo-code and write the C++ code to sort the array, using exchange sort“.

*Ensure that*: (i) The question is connected to the Think phase, i.e., they should use the output of their Think phase. (ii) Two students are required to answer the Pair question, and should be able to do so in about 5-10 minutes. (iii) There is a clear deliverable for the pair. (iv) The question leads to the discussion that you want to carry out later.

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| Classify different materials in these states. Compare the properties of different states of matter.  |

1. **Share phase**: Write a follow-up task that all student pairs should do. Invite a few pairs to share their answer.

*Example from cs101*: “Compare your solution with instructor’s demo program for exchange sort. Identify points where your solution is different and share them with the class“.

*Ensure that*: (i) You have anticipated a few likely responses. (ii) Give about 1 minute for each pair to explain their answer. (iii) Highlight important points (or pros-cons) of each answer. (iv) Invite answers that are conceptually different from previous ones. (v) Summarize the entire discussion after 12-15 minutes, and move on!

*Note*: This works even in large classes, since the responses are likely to fall into a few categories.

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| I will compile the results of all the groups by taking the options of the group one by one. Therefore a table will be formed for comparison. The learners will share their results with the class. The students were asked to share their answers in groups. Summarization of the entire discussion took place. Key points of the topics were stated among students by the instructor and queries were clarified. |

1. Continue further discussion into the topic, as per your plan. If you find that many of the points that you wanted to convey are already covered, then your TPS activity was a success!

**Part 2 (Optional): Refine your TPS activity**

Do either or both of the below:

1. Talk to a colleague who is familiar with your topic or the TPS technique. Get feedback on whether:
2. the statements that you wrote in Part 1 capture what you want students to do in each phase,
3. there is a logical connection between your phases, and
4. the timings for each phase are ok.
5. Predict the responses that you will get from students in the share phase. Use the space below to write down some predictions and later compare them with what actually happens in your class.

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**Part 3: Implement your TPS activity**

Some guidelines for what to do in class when you implement your TPS activity:

1. Don’t panic if no activity happens in the first minute. Students will take time to get started.
2. Do encourage students to write their ideas down, especially during the think phase.
3. Do walk around the class during the pair phase, answer relevant queries, encourage students to talk to their neighbor, and to write down their answers. Keep track of time also.
4. Do discuss a few representative students’ solutions in the share phase, and then transition into points that you want to highlight. It is ok if this phase takes 20% more time than you anticipated.
5. Don’t expect 100% participation. If 80% of your class is participating, you are doing fine. ☺

Appendix: Examples of Think-Pair-Share activities from CS 101 for specific instructional goals

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| Instructional goals | Think Pair Share | Example as shown in the slide to students, |
| Conceptual understanding | *Think* Students write down answer the given question*Pair* Students (i) Identify parts of the answer that they have missed out. (ii) Discuss which answer is better; do pros-cons analysis if there are multiple solutions.*Share* Instructor discusses (i) What are all the essential parts in the answer? (ii) Pros-cons of various solutions given by students | “Consider an unsorted array of N elements.Think: Write the pseudo code for sorting the arrayPair: Discuss your answer with yoru neighbor, do pros and cons analysis of your algorithmsShare: Follow instructor led discussion of your solutions and others.”\*This led to a discussion of various sorting algorithms. |
| Code tracing: Predict the output; Debug/modify the given code | *Think* Students determine and write down the answer.*Pair* Students (i) check each others’ solution (ii) discuss change in code to get others’ solutions *Share* Instructor (i) executes the program and shows the output (ii) discusses a few modifications based on student answers | “Predict the output of the following program:int a = 1, b = 2, c = 3; int\* p, int\* q; p = &a; q = &b; c = \*p; p = q; \*p = 13;cout << a << b << c << endl; cout << \*p << \*q << endl;”Think: Draw the memory arrangement and predict.Pair*:* Check your neighbor’s solution. If you don’t agree, discuss and come up with a solution that you both agree upon.Share*:* See demo of above code and modified versions.”\*The example for the outcome “Debug/modify” is similar |
| Develop programming logic for a problem: Write program. | *Think* Students write down the pseudo-code.*Pair* Students (i) identify missing pieces in each other solutions (ii) write the program.*Share* Instructor (i) shows one possible solution. (ii) Discusses a few representative student solutions.  | “Recall your program to reverse a 4 digit number. Extend your solution to arbitrary integers.Think: Write the pseudo-code individually.Pair: Write the C++ code with a partner.Share: Compare your solution with demo10-reverseNum-mod1.cpp” |
| Design a solution: Write pseudo-code | *Think* Students write down the different parts (structures and functions) of the solution*Pair* Students discuss the pseudo-code for the functions that are required*Share* Instructor discusses a few representative solutions. | “Design a taxi scheduling service for an airport as follows: (i) When a driver arrives, his ID is entered in an array (ii) When a customer arrives the earliest waiting driver is assigned Think: What structures and variables are required?Pair: Discuss the pseudo-code for the functions that are required.Share: Follow instructor led discussion of your solutions and others.” |

End of Resource: *Think-Pair-Share Activity constructor*