

# Preparation Assignment Week 12

## Dewey and Productive Failure

The activity (the core layer of the PF design given in Kapur's paper) is the problem solving done by the students in the solution generation and exploration phase and the assembly into a final solution based on the critical concepts found in the canonical solution given in the assembly phase .

This problem solving happens before any instruction and is mostly unguided. The students are expected to fail in the first phase.

The first phase fits the definition of a reflective experience very well.

- The perplexity stage in the Deweyan cycle is the (yet unsolved) question itself.
- The hypothesis stage in the Deweyan cycle is the adoption of a RSM based on the critical features needed (that the target concepts in the canonical RSM provide).
- The experimentation and data collection stage, is the usage of the chosen RSM to attempt solving the problem and identifying the pain points. This is improved by explanation and elaboration of different RSMs employed by others in a collaborative setting.
- The reflection/update stage is figuring out new critical features needed in case the RSM failed to solve the question.

In phase II (assembly into target concepts) the same cycle is visible except the canonical solution is available. It should be noted that in phase II the students actually *modify* their approaches to incorporate components from the model solution rather than simply following the new method without any reflection. Thus, it's *their* methods that are just being transformed to align with the canonical solution. Basically, the knowledge is constructed (rather than instructed) through a process that mirrors the Deweyan cycle.

A point that Dewey's philosophy disagrees with the activity in PF is the nature of the problem. According to Dewey, the learner must have personal stake in the problem; otherwise it's someone else's problem they are solving. But PF on the other hand says the problem's complexity/difficult must be neither too high (avoiding anxiety and overload) nor too low (avoiding boredom). PF believes that the students need not have a personal stake in the problems, but only be interested enough in them.

Here, I want to point out the reflective-abstraction level instrumentality of schemes (concepts). We (humans) are hard-wired to try out and refine our knowledge even if it's not necessary. This instrumentality is overlooked by focusing only on "personal stake" as a motivation for inquiry.

From a cultural learning pathway p.o.v., the (intrinsic) motivation of the students to solve the problem can be explained by their sense of competence and identity in relation to the domain.

Thus, I heavily side with the approach taken by the Productive Failure pedagogy.

## My experience of Productive Failure

I was constantly going through productive failure for the 2 years of my JEE preparation.

While there was no social surround or participation structure, I still studied very much in line with the PF mechanism.

The knowledge required for the JEE examination can be broadly categorised as

- applied domain knowledge (ADK) : facts and methods that are actually used while solving problems.
- hidden domain knowledge (HDK) : facts and methods that are too cumbersome to apply during the exam but are used for proofs, understanding, etc.
- control strategies (CS) : methods that help in problem solving, such as drawing while reading (for physics problems), getting an analytical expression first before plugging numbers, converting values into SI units before plugging into an expression, etc.
- heuristic strategies (HS) : probabilistic methods that help "solve" the problem by directly getting the answer rather than actually solving for it, such as elimination of options based on units or approximation, trying given options one by one by plugging into the question (for integration questions), etc.

An effective combination of all these skills is needed to score good. Moreover ADK, CS and HS are to be applied in unison, and not in isolation, giving rise to the combined skill, which I will just call "problem solving".

During the last months of my preparation, I was given a massive corpus of questions to train on called the "Final Lap Modules".

I can categorise my preparation components as

- practice sessions focused on improving problem solving (ADK,CS,HS)
- learning sessions focused on improving ADK and HDK

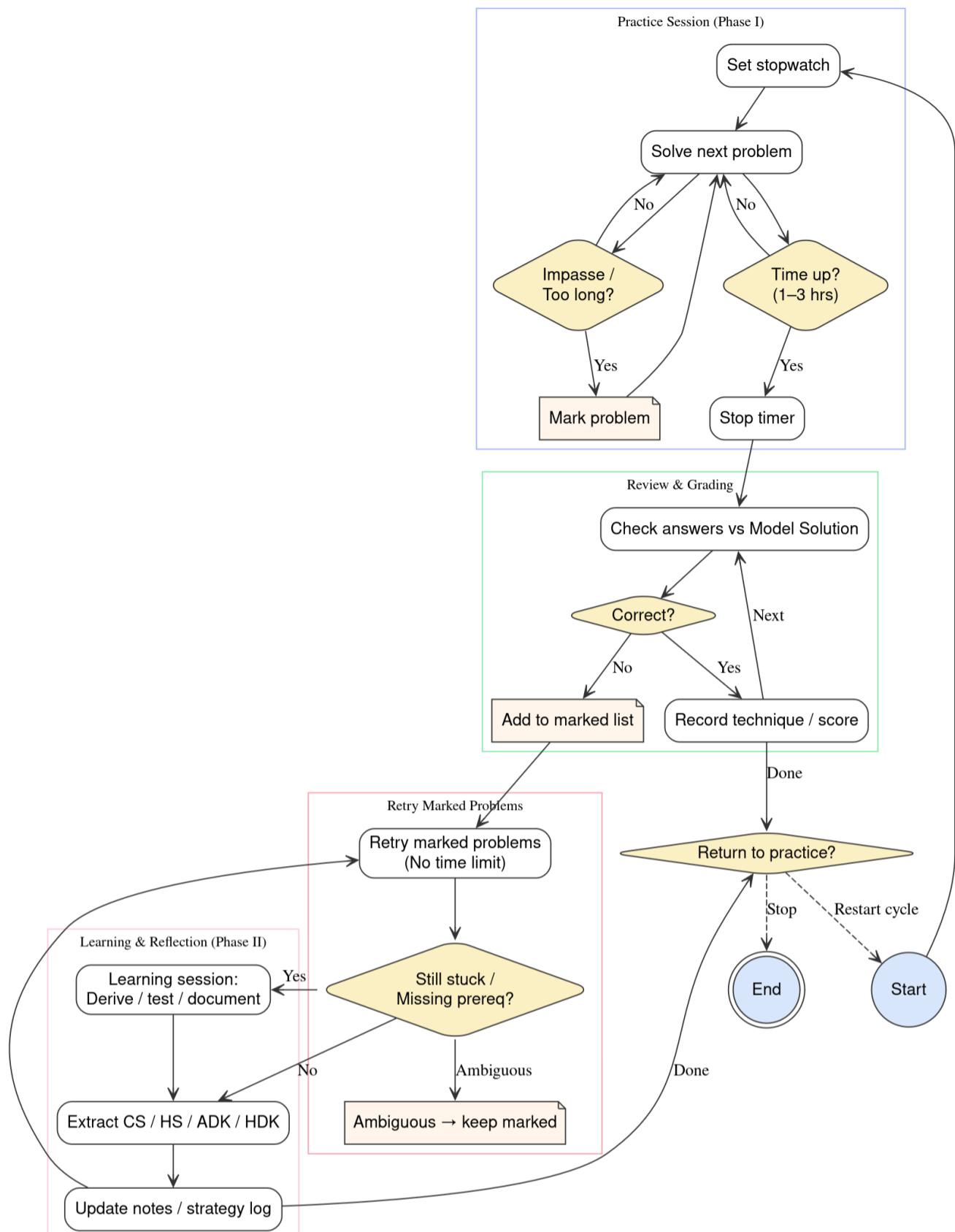
The practice sessions were the cause of the learning sessions which were (unknowingly) based on IBL. There was a lot of derivation, searching, trying, testing, formulation and documentation during the learning sessions. While these were the most interesting parts of my JEE preparation, since the topic is PF, I shouldn't elaborate on this more.

The problem sessions were structured like this :

- Set a stop watch
- Start solving problems sequentially and solve as many as you can, only skipping a problem if it's too long or you have reached an impasse. Mark such problems to review later.
- After 1 to 3 hours, stop the timer
- Check your answers (using the model solution) and thus grade yourself for this attempt as the net score over time taken.
- Try the incorrect problems again to see what could've gone wrong (silly mistakes, conceptual misunderstanding, etc.). If something is ambiguous or too hard to understand, mark that problem too.
- Try all the marked problems sequentially with a relaxed mind now and no time limit.
- For questions that you just didn't have pre-requisite knowledge for, or are stuck on, do online searches.

The last two stages would lead to a learning session usually. Sometimes I would not have any marked problems and I would just reflect on the practice session, getting data for a new CS or HS that I might be experimenting with. This clearly resembles phase II (Consolidation and Assembly) in PF whereas the whole practice session is the phase I (Generation and Exploration).

This flowchart describes the process well :



JEE preparation process