Common Final Exams: For What?

November 29th, 2009

Before anything else, I would like to express my gratitude to the "presumably sick and tired administrator" I already mentioned in earlier **Notes** for prodding me into trying to articulate and formulate my thoughts in the matter of *common final exams* and also to the colleague responsible for confronting me with the tangible issue of a very questionable common final exam.

There are two sides to "learning": There is what the learning process *is*, in and of itself (and the ways it can be helped or hindered), and then there is the *assessment* of the learning process (from whatever viewpoint). While, as I will argue, the two are very far from being independent, here I will focus on the latter issue.

To begin with, it is essential to make several distinctions.

1. The most immediate one is that one does not learn everything the same way. And here I do not mean that "people have different styles of learning". While this is true to some very limited extent, the differences in "learning styles" have mostly to do with *what* is being learned, as opposed to *who* is learning. For instance, one does not learn, say, foreign languages the same way one learns, say, psychology, accounting or algebraic topology. A subsidiary issue is the level and kind of proficiency being sought as, if nothing else, the amount and kind of "investment" one had to incorporate in the learning process are going to be very different: even if one is eventually to play the same music, one does not learn playing the piano to play in tearooms the same way as one would learn eventually to be able to give recitals at Carnegie Hall. For instance, in the latter case, one must invest heavily in solfège while one may perhaps not have to do so in the former case. Thus, before we can talk about how to assess a learning process, we must begin by specifying what the learning process is to be about.
2.
3. Another distinction must be made, namely that between evaluating the learning process itself and evaluating the extent to which the result of the learning process works in the real world. For instance, I may have learned "all about" multiplication of counting numbers but, when in a given real world situation, I may not be able to perform multiplications in a way appropriate to this real world situation. For instance, the particular situation may call for multiplication of 8 digit numbers and while I may have no problem doing that, I may be too slow for what the situation requires. This is in fact exactly what led to the funding of the original development of digital computers: it was not that the people involved in computing artillery trajectories "by hand" could not do it, it was that there was no way they could do it fast enough.
4.
5. However, perhaps the most important issue is that no matter what the learning process

is about, we must distinguish the *external evaluation* of the learning process from the *internal evaluation* of what one is doing as one is learning. As I am learning how to cope with a situation in a chess game, I must evaluate various possible moves as to their likely consequences. The external evaluation might–but need not–be the extent to which I win games. Yet, a major issue is that the extent to, and the manner in, which the learning process itself can depend on its external evaluation is not at all obvious: since any kind of evaluation procedure ought at least to specify what it is that it is testing and what it takes to pass, the evaluation of the output of the learning process cannot but influence the learning process itself. Not to dwell on the very real danger of "learning to the test": If I know that I am going to be tested on endgames, this will not encourage me to study openings and so I will not really have been learning to play chess. On the other hand, the particular way I am assessing various possible moves in a given situation might help an external observer assess the learning process I am undergoing.

6.

Here I will concern myself with "developmental mathematics" since this has become a major issue in two-year colleges, if not beyond, and, of course, since this is what this site is entirely devoted to.

I will begin by further considering the above three distinctions in the case of *developmental mathematics*:

1. While the learning process in "developmental mathematics" must, per force, be *the* way mathematics *has* to be learned, in fact, in the case of developmental students, who
    - are not only adults but adults who have been severely maimed by their previous education in "math",
    - tend not to come from the most economically favored part of the population so that not only does their social status put a considerable economic burden on them, it is also not exactly conducive to the complete trust in oneself that is absolutely necessary for memorization.
2. this learning process must be even more based on *logic* and *discussion* and, to that effect, be given a lot of time and tender loving care: Indeed, while comfortable,"made" mathematicians can be expected to be able rapidly to take some things of faith, like "named" theorems, developmental students, having been betrayed so many times before, are absolutely not capable to do so.
   For a further discussion of this aspect of the problem, see Chapter Thirteen and "Math Anxiety"

3.
4. Inasmuch as we are dealing with developmental students, the real world situation that is most … real for them is the college level course they hope to be taking afterward. This means that reliance on so-called "real world applications" to justify matters is not likely to appeal to them. Even more importantly, it also means that ***the one and only external evaluation of a developmental mathematics course is how students do in subsequent course(s).***

   As for a *predictive* assessment of a developmental mathematics course, it should focus

at least as much on the "developmental" as it does on the "mathematics": ***We certainly cannot assess the extent to which the students will be able to operate in the subsequent college level courses by just measuring their proficiency on developmental mathematics items.***

5.
6. As a result of the particular characteristics of the developmental population mentioned in 3. above, the external evaluation of the learning process would seem to have to be very close to the internal evaluation by the students themselves of what they have to do in order to deal with the mathematical situation they are confronting. For instance, to evaluate a developmental student's learning of chess, one would have to check how the student evaluates her/his possible moves in a given situation. Just to count how many correct moves the student has chosen will not tell anybody anything about whether or not the student will be able to play real games.

   In the same manner, to find what the student will respond to:

   Compute, if possible. If not possible, write "not possible": 3–7

   is not going to help us assess whether or not the student understands the most important difference between *counting numbers* and *integers*.
   What is important here is to make sure that the student realized that the definition of the *addition of integers* involves several notions: the *size-comparison of integers*, the *addition of counting numbers* and the *subtraction of counting numbers*. Whether we like it or not, nothing short of that can prevent the students from making "common mistakes" and/or will shield them from "common misconceptions".
   Nor will

   Determine whether the following represents an equation or an algebraic expression. Any time you find an equation, circle its left hand side: 4x+2 = 7

   help us decide whether or not the student understands the difference between an *equation* and an *algebraic expression*.

While one might well accept the impossibility for *"non-mathematician" administrators* to deal with such matters as I have mentioned above, it is already more difficult to see how *"math ed" faculty* can fail to recognize the nature of the difficulties encountered by students in developmental mathematics and how they can support approaches based, when all is said and done, on *memorization*. However, it is quite impossible to understand how *faculty who teach both college level courses and developmental courses* can fail to see how what they are doing when they teach developmental courses cannot possibly help their developmental students to succeed in college level courses. It certainly speaks a lot about their lack of self-knowledge, about their relationship with mathematics. But that is quite another story.

Finally, and to come to the point of this **Note**, there is the issue of "common final exams". A major reason for them is that the faculty teaching developmental mathematics has to justify

what it is doing to two very different bodies:

- To the administration inasmuch as the latter must enforce a legitimate societal demand,
- To the faculty who teach subsequent college level courses.

For the curious reader, my own response in the case of **Reasonable Basic Algebra** can be found at Three Exams.

In another installment of these **Notes**, I will discuss the pro and con of *final exams* versus *make-up exams* and of other, possibly more effective, ways to reconcile the faculty with the realities of developmental mathematics. One possibility for instance would be to have faculty teach college level courses to students coming from developmental classes that they themselves have taught. Perhaps difficult to implement but where there is a will … .

I will also discuss the issue of how to let multiple sections taught by different instructors remain consistent without infringing on academic freedom and, which is the least of the problems, how to have common exams acceptable to all the instructors.

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