home ChE concepts to students.

I used two simple criteria to evaluate the student work: 1) did the topic illustrate some concept relevant to the course? and 2) was there an attempt to put some thought into the work? Every student except one composed one poem, and some even composed two! Overall, I was impressed with the level of humor and the clever use of language that the students put into their poems. By framing the poem assignment to illustrate a mass transfer operations concept, students attempted to use analogies to explain technical concepts, and in so doing exercised creativity and higher-order thinking skills. Above all, however, an "affective objective," described in Bloom's Taxonomy,[4] may have been attained. The assignment was perceived as unique and fun by the students. Therefore, their attitude toward the subject area may have been positively affected by the assignment, which in turn would stimulate sustained interest in the subject area.

Students in engineering generally appreciate a diversity of activities in their coursework experiences.[5,6] A little levity is sometimes needed in senior-level courses where engineering students are burdened with the pressures of career decisions, difficult course material, and time-consuming projects. In this regard, timing a short poem writing assignment near the end of the term lifted the students' spirits a little and put a smile on this instructor's face as well.

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Letters to the Editors of the "Class and Home Problems" Column

Dear Sirs:

I am writing to you regarding the article "Distillation Column Performance," by J.A. Shaeiwitz, in *Chemical Engineering Education,* **29**(4), pages 240-243 (1995). The problem is interesting in that it sets out to examine operation of an existing piece of equipment rather than designing a new unit (which is the most common form taken by many chemical engineering exercises). However, considerable care is needed with such problems if the wrong conclusion is not to be reached.

In this problem, there are two aspects that really need further consideration.

A. Tray Performance • In many distillation services, small reductions in feed rate will allow pro-rata reductions in all other flows and their related heat-exchanger duties. However, as the reduction approaches 35% of the original throughput, weeping will become significant for sieve trays and mass-transfer performance starts to decline—that is, the required separation is not achieved. Further feed-rate reductions will not permit corresponding reductions in heat loads; the heat input must be maintained to produce sufficient vapor flows to limit weeping (obviously, the condenser duty and liquid flows will follow). In summary, at low throughputs, the column must be artificially loaded and energy-efficient operation is not possible.

The exact amount of turndown possible depends on where the original 100% point lies in the sieve-tray operating envelope, and the important point to note is that it is unsafe to assume that halving the feed rate allows one to pro-rate down all flows and duties without detailed consideration. If feed rate reductions larger than 30-40% are likely to be required on many occasions, the designer should specify valve trays.

B. Condenser Operation • Most condensers are designed with cooling water flowing in the tubes at a velocity of 1.5 to 2.0 m/s; the very minimum velocity suggested is 1.0 m/s. Generally, a maximum cooling-water return temperature of 45°C is used. Both of these parameters are based on operating experience and are intended to limit heat-exchanger fouling and corrosion. In the proposed solution, a velocity well below 1.0 m/s will result if the cooling water is reduced by

65%. This, combined with a cooling-water return temperature of 51°C, *i.e.,* 6°C above the suggested maximum, will lead to severe tube-side problems if extended operation is undertaken in this mode. It is perhaps worth observing that a reduction in cooling-water velocity from 1.5 to 1.0 m/s defines the practical turndown of a condenser, and this is broadly in agreement with the limit of energy-efficient turndowns as discussed in A above.

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Author's Response

Dear Sirs:

I thank Professor Jones for his interest in the problem titled "Distillation Column Performance." His observations regarding tray performance and condenser operation are correct, and the assumptions made in this regard should have been clearly stated.

When this problem is assigned to students, the purpose is to demonstrate the interrelationship between a distillation column and the required heat exchangers. The problem, as presented, demonstrates that neither can be analyzed in isolation from the other.

Professor Jones' observations suggest an extension of this distillation column performance problem, illustrating the richness of open-ended problems. After solving the distillation problem as in the paper, the problem with tray performance and condenser operation could be pointed out to students. They would then be asked to suggest alternatives for compensating for tray performance and condenser operation limitations.

Numerous alternatives exist, and the new assignment would be an excellent creativity exercise. One alternative is to replace equipment. Valve trays and small-diameter condenser tubes could be installed. Another alternative is to maintain the original boil-up rate from the reboiler, or just increase the boil-up rate from the scaled-down value enough for the trays and condenser to operate correctly. This option also requires an increased reflux ratio, which should result in a better separation. If a better separation were not desired, the feed location could be moved, equipment permitting, to reduce the separation.

Consideration of these two alternatives might lead to a discussion of the economics of replacing equipment versus changing operating conditions.

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ChE stirred pots

To the Editor:

A while ago I downloaded from the Internet a program called Karma Manager, which makes anagrams of any word or phrase you input. It determines all possible sets of words that can be made by rearranging the letters of whatever you type in (ignoring spaces), and it returns each set to you in a list. After typing in a few names and finding little (six entries for my name, the most interesting being "kava kid of Ed"), I entered "thermodynamics" and observed over 10,000 anagrams emerge! Karma Manager merely presents the sets of words, without ordering them in a way that might make sense. I didn't have enough free time to look at them all, but here are some of the interesting ones I found.

dim men try chaos	sir, end thy comma	some rancid myth	had my nice storm
consider my math	cram into my shed	mystic harm done	sad men cry to him
charm in modesty	emit many chords	them micron days	scorn media myth
my romantic shed	so I mend my chart	dim men crash toy	scare my hot mind
its my amen chord	many cords hit me	I deny most charm	macho men sit dry
my sham doctrine	my thin comrades	some thin mad cry	most handy crime
my hindmost care	do me in my starch	Oh stem racy mind	not my cider mash
hamster in my cod	decant or shammy	short icy madmen	shy men or dim cat
shy dormant mice	my damn sore itch	my son came third	me and my ostrich

Karma Manager (which itself is an anagram) can be obtained by going to the Web site http://www.shareware.com and searching on "Karma."

David A Kofke • SUNY at Buffalo