[illegible] PROCESS DESIGN — A SURVEY OF APPROACHES TAKEN

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ABSTRACT

A detailed survey of fifty universities revealed that the major difficulties in teaching process design are lack of time, difficulty in choosing a project topic, inadequate student background, vague teaching philosophy, and encouraging creativity. Comments and suggestions for minimizing these five difficulties are given. Summary tables and figures of the data received from the questionnaire are presented.

The emphasis in the report is to share as much information as possible about teaching process design. Statements are clearly refer-

SELECTED DATA FOR CHEMICAL ENGINEERING UNDERGRADUATE

by C. W. Balch
Dean of Adult and Continuing Education

and

G. F. Bennett
Associate Professor of
Biochemical Engineering

The University of Toledo
Toledo, Ohio

In the spring of 1970, questionnaires were sent out to all chemical [redacted] in the United States and Canada. Of the 154 sent out 98 were returned for a 62% success factor. Selected data are reported here.

[redacted] to undergraduates:

6. Time Analysis: How did you devote your time -

	First Design Course	Second Design Course
Lecture	49%	44%
	51%	56%
Other	39%	49%

7. Approach used:

Course		
First	Second	
(a) 31%	16%	Overall plant design with construction and operating cost estimates plus return on investment.
(b) 10	4	As above plus comparison of alternative route plus

Source of problems (outside of AIChE) ranked in order of importance

0 (no response) 1 (highest) 5 (lowest)

	0	1	2	3	4	5
Professor's background	20%	40	34	1	4	0
Text	67	10	11	8	2	2
Industry Supplies	75	7	7	6	2	2
Washington University Course Studies	47	18	29	5	1	0
Other Course Studies	72	5	14	7	1	1

9. Industrial Participation.

(a) Is it practical - 61% affirmative

... to what extent - Complete Substantial ... Moderate 32% Little 14% No Resp. 34

[redacted] and projects.

[redacted]

Library Use	79	37	39
Cost Evaluation Project	76	39	44

[redacted]

Report Writing	68	38	44
Cost Estimate of Alternatives	67	34	36
Rule of Thumb Design	68	29	32
Estimation of Physical Properties	64	29	41
Optimization	62	37	33
Computer Programming	61	36	26
[redacted]	[redacted]	[redacted]	34

AMERICAN INSTITUTE OF
CHEMICAL ENGINEERS

COMMITTEE CORRESPONDENCE
In reply please address:

C. W. Balch, Dean
Division of Adult & Cont. Ed.
The University of Toledo
2801 West Bancroft
Toledo, Ohio 43606

March 11, 1970

Memo to: Chemical Engineering Department Chairman

From: C. W. Balch and G. F. Bennett

Subject: Chemical Engineering Design Questionnaire

In preparation for a Symposium on Chemical Engineering
[redacted] annual meeting in

March, 1970

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Education Projects Committee

Undergraduate Education Subcommittee

Design Questionnaire

[redacted]

[redacted] C. F. Bonnett

(Please check one of following)
This institution is on the:

Quarter System _____

Semester System _____

Trimester System _____

Other _____

_____
Name of University

_____
Name of Professor Completing Questionnaire

[redacted]

design that are: A. Required -- 0 1 2 3 B. Optional -- 0 1 2 3

II. What is the total equivalent semester hours involved in these courses:

A. Required: _____ B. Optional: _____

III. How many students did you have in your first design course this year_____?

[redacted]

V. When may first design course be taken? (Circle one)

A. Junior Year

1. First Semester

VI. What are the important prerequisites and corequisites to this first course?

	Prerequisites	Corequisites
A. Unit Operations	1 _____	2 _____
B. Transport Phenomena	1 _____	2 _____
	1	2
D. Thermodynamics	1 _____	2 _____
E. Economics	1 _____	2 _____
F. Physical Chemistry	1 _____	2 _____
G. Computer Programming	1 _____	2 _____
H. Other _____	1 _____	2 _____
I. _____	1 _____	2 _____
J. _____	1 _____	2 _____

VII. How is the time devoted (by %) in first design course:

A. Lecture _____ C. Laboratory (experimental) _____

B. Calculation Period _____ D. Other _____

VIII. How is the time devoted (by %) in second design course:

A. Lecture _____ C. Laboratory (experimental) _____

B. The students working as you have indicated above attempt to solve:

(Circle one)

1. Different Problems

2. The Same Problem

3. Variations of the Same Problem

XI. Which of the following most nearly describes the approaches used: (Mark one correct answer for each course)

A. First Course	B. Second Course		
_____	_____	1.	AIChE contest problem
_____	_____	2.	Single piece of equipment design
_____	_____	3.	Single step of a process
_____	_____	4.	Battery limits process design
_____	_____	5.	Overall plant design
_____	_____	6.	Overall plant design plus site selection
_____	_____	7.	Overall plant design with construction cost estimate
_____	_____	8.	Overall plant design with construction and operating cost estimates
_____	_____	9.	Overall plant design with construction and operating cost estimates plus return on investment
_____	_____	10.	Overall plant design with construction and operating cost estimates plus return on investment
_____	_____	11.	Overall plant design with construction and operating cost estimate plus return on investment plus comparison of alternative route plus

XII. If you do use the AIChE contest problem, how? (Circle answer)

[redacted]

C. At student's option to choose a or b route

D. Other (state) _____

XIII. If you do not use the AIChE problem or use other problems in addition to it, what is your problem source. Please rank (in margin) in order of importance (1st, 2nd, 3rd, 4th, 5th)

_____ A. Professor's background

_____ B. Text (s) (list by author) (1)_____

(2)_____

[redacted]

_____ C. Industry supplies

_____ D. Washington University Case Studies

_____ E. Other case studies (source)_____

(nature)_____

XIV. What texts do your students normally purchase (state by author).

_____

_____

_____

B. If so, please rate degree of utilization. (A for high, F for low)_____

XVII. In your opinion, is industrial aid in your design courses practical in your

[redacted]

[redacted] if you feel aid is practical, to what extent is

[redacted]

B. Moderate

D. Complete

[redacted] aid is practical, have you utilized it? (Yes) (No)

[redacted]

A. Little

C. Substantial

[redacted] handles

XXVI. A. Have you ever been able to make field trips to inspect the process involved? (Yes) (No)

B. If yes, do you consider them valuable (A) or of no use at all (F)?

Please rank _____

[redacted]

None _____ Some _____ Entirely _____

B. What sources do they use (check answer(s)):

Literature _____ Laboratory _____ Estimation _____

XXVIII. Do you include any work to stimulate "social" awareness e.g. pollution consideration, impact of technology on society, etc.? Please comment:

_____

_____

_____

B. Have there been any problems in the design area in cooperation or attitudes of

XXX. Topics Experienced in Course & Project

Topic	Design Course		Design Project
	First	Second	
A. Optimization			
B. Decision Theory			
C. Computer Programming			
D. Rule-of-Thumb Design			
E. Mechanical Design			
F. Working Drawings/Layout			
G. Scale Model Construction			
H. Piping Layout			
I. Cost Estimates of Alternatives			
J. Cost Evaluation of Project			
K. Equipment Design (Hardware, etc.)			
L. Process Design (Kinetics, Chemistry, etc.)			
M. Materials Selection			
N. Process Control			
O. Estimation of Physical Properties			
P. Pollution Consideration			
Q. Use of Library			
R. Report Writing			

3.7 More Information

The purpose of this summary is not just to present some of the impressions I gained from the survey, but to share as much information about [redacted] design teaching as possible. It is hoped that the list of respondents [redacted]

[redacted]

[redacted] Dixon