Table 2. Breakdown of unemployed by degree

Age	BS/BA	Rate (per cent)	MS	Rate (per cent)	PhD	Rate (per cent)	Less than BS or no report
24 and under	6	7.0	3	4.8			
25–29	134	7.6	195	8.7	14	1.6	3
30–34	71	5.7	161	6.5	64	1.7	1
35–39	36	4.9	60	4.1	53	1.8	
40–44	23	4.2	47	4.6	38	1.6	1
45–49	30	6.0	30	3.3	32	1.7	
50–54	20	5.7	19	3.5	26	2.6	
55–59	6	3.7	8	2.2	13	2.0	1
60–64	3	3.7	5	2.1	11	2.9	
65–69	1	4.2	1	1.1	2	1.0	
70 and over					4	7.3	
No report	2	12.5	1	14.3	1	6.7	
Average		6.0		5.6		1.8	
Total	332		530		258		6

seem to have less of a problem than young PhD chemists, for 3.8% of the PhD chemists in the 25–29 age group are unemployed as compared with 1.6% of this age group for PhD physicists.

Although the rate of unemployment is generally higher for scientists with lower degrees, this trend is especially pronounced for physicists. For while the unemployment rate for BS or BA-degree physicists (6.0%) and for MS-degree physicists (5.6%) is more than three times the rate of unemployment for PhD physicists (see Table 2), the unemployment rate for BS or BA chemists is 3.5%, for MS chemists, 3.5% and for PhD chemists, 2.1%; the unemployment rate for BS or BA engineers is 2.8%, for MS engineers, 3.2% and for PhD engineers, 1.9%.

Despite the low rate of unemployment for PhD physicists as compared to other scientists (as shown by the NSF results), the NRC survey indicates that the percentages of unemployed and underemployed among the 1970 physics graduates were both almost twice those percentages for all sciences. The NRC survey, conducted in the winter of 1970–71, also surveyed 1969 graduates and found a sharp increase in the rate of unemployment and underemployment of the 1970 graduates over the 1969 graduates at that time. Of the 1287 PhD physics graduates in 1970, 2.1% were employed in positions where their skills were not being utilized, 2.3% were still seeking employment and 0.6% were no longer seeking employment. Of the 1104 graduates in 1969, only 1.1% were underemployed, 1.2% were seeking employment and 0.3% were no longer seeking employment. The larger rate of unemployment for 1970 graduates may indicate a tighter job market, but it is also an indication of the importance of an extra year in obtaining employment.

The AIP survey, conducted in November 1970, concurs with the NSF survey's findings that PhD physicists have less difficulty finding jobs than do physicists with lower degrees; for of the 2700 physicists having job difficulty that were surveyed, 15% of those with MA degrees and 23% of those with BS degrees were still unemployed after six months of job hunting.

The survey, which focused on 1970 graduates, indicated that a large number of the employed PhD physicists only held temporary postdoctoral positions. However, the majority (214) of the 321 permanently employed PhD physicists who received their degrees in 1970 (and were having job difficulties), were employed in positions that require an extensive use of physics and only 14 did not use their knowledge of physics at all. This distribution was less true for MA physicists, where only 7 of the 44 employed physicists extensively used their knowledge of physics and an equal number did not use physics at all; for BA degree physicists, 18 of the 128 employed physicists extensively used physics and 49 did not use physics at all.

AIP is planning another employment survey to follow up these 1970 graduates and to examine unemployment among the 1971 graduates. —MW

U of Washington to study science-society links

"Social Management of Technology," a research program at the University of Washington, has been initiated under an initial grant of $158 000 from the National Science Foundation. The purpose of the program is to develop a model for the interaction of science and society and evaluate how scientific and engineering developments can be steered to meet the social and economic needs of the future. The principal investigator is Edward Wenk Jr, a professor of engineering and public affairs. Ronald Geballe, chairman of the physics department, is one of the co-investigators.

the physics community

Physics teachers find Keller-plan courses work

A recent conference at MIT's Education Research Center on the Keller plan attracted about 350 natural and social science teachers, including 75 physicists. The Keller Plan, a method of self-paced, mastery-oriented instruction has been gaining in popularity among physics teachers, ever since its popularization by Fred Keller, formerly head of the Columbia University department of psychology.

According to Ben Green Jr, staff physicist at ERC who organized the conference, several freshman courses in physics with large enrollments are using the Keller Plan and a greater number of smaller courses are trying it out.

Under the plan, the coursework for a semester is divided into a number of units, typically 15 to 20, with a study guide for each one. The guide tells what the student is expected to learn in the unit and then suggests ways that he might go about it. Each student proceeds with his work at his own pace, but he is allowed to advance to a succeeding unit only after having passed a brief quiz on the material. Several tests are provided with each unit, and failure on a test is not counted "against" the student; he simply has to study until he masters the material.

At MIT there are Keller Plan sections in six courses. The first semester of a five-semester introductory sequence was taught in the Keller style. Robert Hulsizer coordinated the course for 500 MIT freshmen.

Hulsizer's course involved 14 faculty members, 7 graduate students and 32 undergraduate tutors, who worked for academic credit. The course work was divided into 17 units and students were required to pass tests on each one to get a passing grade in the course.

How did it go? "I'm completely sold on it," Hulsizer told us, "I think it's far more successful than a recitation section

Self-paced instruction at SUNY, Stony Brook. An Indian graduate student watches an experiment on conservation of angular momentum.

type course." As for the students, their professor estimated that three quarters of them liked it, one-eighth were neutral and one-eighth didn't like it. Hulsizer also said that the tutors felt that they learned so much from teaching, they were willing to work without pay.

Clifford Swartz, physicist as SUNY, Stony Brook and editor of *The Physics Teacher*, appears sold on the plan too, although he questions the association of Keller's name with it. According to Swartz, similar systems of teaching have been around since 1903 when Frederic Burk first introduced one at the San Francisco Normal School. At present over 400 students are enrolled in a self-paced course at Stony Brook, which has provision for students to choose from a wide variety of units including those with calculus and those without. Labs are operated as an integral part of the independent-study program. Swartz says that there are few schools where this is done.

In order to get some unbiased data on the effectiveness of the method, Michael Philippas and Raymond Sommerfeldt at Portland State University split a non-calculus introductory physics course into two random groups and taught one of the groups with the Keller Plan, the other with an ordinary lecture and recitation organization.

Both groups took the same final exam, and Philippas reports that there was no significant difference between the scores of the two groups. There were other differences, however. Of the 100 students who started in the Keller Plan group only 55 finished the whole course. Seven received "incompletes" and the rest withdrew. The lecture course lost only 26 students. Philippas said that the ones who did stay in the Keller Plan course were more enthusiastic than those in the conventional one.

All those interviewed agreed, however, that more work is involved in teaching a Keller Plan course. "If a person wants to do more work and do a good job he can use the Keller Plan," says Hulsizer. "On the other hand, he can use the recitations and lectures and do a perfectly good job."

The plan is, of course, not without its difficulties. Paul Szydlich reports that during the beginning stages of a Keller Plan course in introductory physics at Plattsburgh, four young women became so upset by the news that they had not passed the first test that they all began crying in the lab. Szydlich said however, that the situation was eventually straightened out to the satisfaction of all concerned.

There is little doubt that use of the Keller Plan in physics teaching is spreading. 75 physics teachers attended the MIT conference and of these 22 said that they already were teaching, or planned to start, Keller-type courses. According to Swartz, the lack of published materials is a significant factor preventing more rapid spread of the plan.

It takes a great deal of time to write the syllabus for a Keller Plan course and debug it during operation. Swartz hopes that publishers will soon include Keller Plan syllabuses in their textbook offerings. —SMH

AIP publishes second conference proceedings

Particles and Fields—1971, the proceedings of the Rochester meeting of the APS Division of Particles and Fields, 30 Aug.-2 Sept. 1971 has just been published, according to Hugh Wolfe, series editor of the AIP Conference Proceedings Series. The hardbound book includes most of the invited papers presented at the plenary sessions of the conference as well as some of the papers given in other sessions.

Particles and Fields—1971 is the second in the AIP series. Proceedings scheduled to be published include conferences on Thermal Expansion, 26–29 Oct. 1971 at Corning, N. Y.; Superconductivity in d- and f-band Metals, 29–30 Oct. 1971 at the University of Rochester; Magnetism and Magnetic Materials, 16–19 Nov. 1971 in Chicago, and Particle Physics, 3–4 Dec. 1971 at the University of California at Irvine. The magnetism proceedings have been published for many years in the *Journal of Applied Physics* and will now appear for the first time in the AIP Conference Proceedings series.

Quantum-electronics journal translated

The American Institute of Physics recently announced the publication of a new bimonthly journal, the *Soviet Journal of Quantum Electronics*, translated from the Russian *Kvantovaya Elektronika*. The journal will publish papers reporting experimental and theoretical work on quantum electronics and applications in science and technology, including lasers, interaction of coherent radiation with matter, holography, nonlinear optics and related topics.

The editor of the journal is Nikolai Basov, who, with Charles Townes and Aleksander Prokhorov, won the 1964 Nobel Prize in Physics for work that led to the development of the laser. According to Hugh Wolfe, managing editor of AIP translation journals, the Soviets anticipated the wide reception of this journal by Russian scientists; they printed twice as many copies of *Kvantovaya Elektronika* as of *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Soviet Physics-JETP).

AIP will offer the first issue of the translated journal in December 1971. A total of six issues will be translated by June 1972, after which publication will lag the Russian issue by six months. The journal will cost $50.00 per year, and single copies are $10.00.

Translations Center announces new index

The National Translations Center at the John Crerar Library in Chicago is the principal US depository and information center for scientific and technical translations. The center, which prints a semi-monthly list of newly acquired translations, *Translations Register-Index*, which is available on subscription for $50.00 per year, is now planning a five-year cumulative index for 1967–71.

The center is supplied with translations prepared by Government agencies, industrial and research organizations and academic institutions, originally for their own use and then deposited at the center. The center, which also serves as an international clearinghouse of information on translations available from any known source in the US or elsewhere has, in addition to its own collection of 170 000 translations, information on over 250 000 translations available from other sources.

Operated under the guidance of an advisory board consisting of representatives of 15 professional societies, including the American Institute of Physics, the center is now partially funded by a service charge. However, the center is hoping for increasing self-support by expanding the subscription list of *Translations Register-Index* and by increasing the number of translations supplied.

Further information may be obtained from the National Translations Center, The John Crerar Library, 35 West 33rd St, Chicago, Ill. 60616. □