

A SURVEY OF JUNIOR COLLEGE PHYSICS CURRICULA AND TEACHER PREPARATION

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by

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CHAPTER I

INTRODUCTION

The institution of the Community Junior College is an educational innovation of this century. It has been growing in importance and number since its inception. The 1950 Junior College Directory reported 590 such institutions. By 1973 the number of Junior Colleges listed in the Directory almost doubled.¹

One of the reasons for the success of this genuinely American institution is that it has been molded to the needs of a much larger cross-section of the population than the four-year institution. Besides serving the freshman and sophomore college students, it serves adults with other educational goals such as vocational and semiprofessional careers, skill improvement in their jobs, or simply cultural enrichment.² In order to do this, the Community College offers a variety of programs and courses in academic, vocational and general education areas according to the community's interests. Some programs are offered at night for the convenience of the working people. To make itself more accessible the Community College practices an open-door admission policy and in some states such as California they are free of charge.³

One might expect that an instructor at a Community College would have a very different group of students and curriculum than the instructor at a four-year college or a secondary school. In order to succeed, an instructor should be well prepared and highly motivated.

In the last five years there has been a growing interest in Junior

College curricula and in the preparation of Junior College teachers. The purpose of this study was to determine the types of courses that a prospective Junior College physics instructor can expect to teach, the extent of preparation needed and the nature of students he encounters.

STATEMENT OF PROBLEM

This study will seek data to answer the following questions:

- 1) What types of courses are taught most often at Community Colleges--Engineering Physics, General Physics, Technical Physics or Physical Science?
- 2) How much emphasis does each of these courses place on laboratory work, lectures, discussion sessions and use of programmable calculators?
- 3) What physics courses and what non-physics courses are thought by Junior College Physics Department Heads to be most necessary in order to teach Junior College physics? Should the Junior College physics instructor expect to teach non-physics courses?
- 4) Are the students taking these courses mainly transfer students or students who plan to terminate their education at the Junior College?
- 5) How do the responses to questions 1-4 above relate to the size of the Junior College?

IMPORTANCE OF STUDY

A review of the literature reveals that very little has been published regarding Junior College Physics Teaching. At the present, a

person considering this position has very little knowledge of what preparation and duties will be expected of him at the Community College. The literature does not indicate if a degree in the field or just a strong preparation is needed to teach at such an institution. There is scant research done in the area of physics at the Community College on a regional scale and no research reported on a national scale. Because of a lack of published information on the subject, a study of this nature could be of great benefit to four-year colleges setting up teacher training programs for two-year colleges and to people that wish to teach Physics at the Junior College. The results of this study would also provide a convenient method for Community Colleges to compare their Physics curriculum, physics teaching practices, and physics teacher preparation to those of all other similar institutions in the country.

Reynolds comments that the Junior College has been the basis of several Masters theses and dissertations. He adds, "In the face of this mountain of literature already in existence, it is interesting to observe that there is not an up-to-date volume dealing with the Junior College curriculum. This need exists not only for students of the movement, but for the thousands of new staff members in the increasing numbers of Junior Colleges."⁴

OPERATIONAL DEFINITIONS

COMMUNITY JUNIOR COLLEGE - A two-year institution of higher education that offers the first two years of education that a four-year college offers and terminal vocational programs. For the purposes of this study

the names Community Junior College, Community College, Junior College, and Two-Year Institution are used interchangeably.

TRANSFER STUDENT - A student at the Junior College level planning to attend an educational institution beyond the Junior College.

VOCATIONAL STUDENT - A student enrolled in a terminal two-year program at the Junior College.

ENGINEERING PHYSICS - A course where calculus is used regularly and formula derivation is emphasized as much as conceptual understanding and problem solving.

GENERAL PHYSICS - A course where the math level is not above algebra and trigonometry. Problem solving and conceptual understanding are emphasized over formula derivation.

PHYSICAL SCIENCE - A course where the math level is not above high-school algebra, problem solving and formula derivation are not emphasized, and conceptual understanding is the single most important objective. Physics isn't the only subject matter taught in a Physical Science course. Other science topics such as Chemistry, Astronomy, Meteorology and Geology are taught along with physics. For the purpose of this study, courses under the name of Astronomy, Meteorology, and Geology were considered Physical Science courses along with those under the name of Physical Science.

TECHNICAL PHYSICS - A course where the math level is not above algebra and trigonometry, and industrial applications and concepts are emphasized over formula derivation. Problem solving is more confined to the industrial applications area.

LABORATORY WORK - Task performed in a physics laboratory that involves

manual and mental work.

DISCUSSION SESSION - A class period, smaller and more informal than a lecture, geared to aid students work problems and understand the concepts taught in lecture.

PROGRAMMABLE CALCULATOR USE - Ready access to a desk-top programmable calculator and knowledge of its operation. This access is both to the faculty and the students.

CHAPTER II
REVIEW OF THE LITERATURE
PHYSICS CURRICULUM

The following results were compiled from a questionnaire submitted in 1971 by Dr. J. D. Spangler, Physics Department, Kansas State University, to the physics instructors of the 26 Junior Colleges in Kansas.

Responses from 17 instructors at 14 institutions showed:

11 institutions offered Engineering Physics

14 offered General Physics

13 offered Physical Science

1 offered Technical Physics

6 reported having a computer available

2 instructors held a degree in education with majors in physics and math

7 instructors held an education degree with majors in related science fields such as chemistry, biology, geology or general science

1 instructor held a degree in biology

Of the 7 remaining instructors, 2 had degrees in physics and 5 in related science fields but it was uncertain as to whether these degrees were actually in the mentioned fields or they were degrees in education with majors in the field.

Dr. B. G. Aldridge, a physics faculty member at Florissant Valley Community College in Missouri, wrote an article in Physics Today about their physics department, curriculum and students. In summary, this Junior College offers Engineering Physics, College Physics (General Physics), Technical Physics, and 4 courses which by this study's opera-

tional definition would be Physical Science. These are Physical Science, General Astronomy, Basic Science, The Impact of Science on Man. Basic Science is a remedial course to help students lacking "certain skills" in science and math.

Because of the open door admission policy of the school, there is a wide range of abilities within each class. This poses a problem for the instructor who is responsible for the preparation of students who will transfer. Another problem has been the lack of motivation and interest on the part of the students--especially the vocational students. Most students taking these physics courses go into pharmacy, engineering, or become laboratory technicians. One attempt at motivating the students has been through individualization of instruction in the laboratory and lecture. The students are provided with a set of carefully prepared units to learn independently and discuss individually with the instructor. In the laboratory, students from all courses come in at any time to work on projects of their choice at their own rate. The laboratory is always staffed with a faculty member.⁶

In San Francisco at a meeting of the American Association of Physics Teachers, Schrautemeier presented a paper discussing the problems faced in offering physics at a Community College. One problem cited was that the functions at such an institution are varied and complex. These include traditional college education, occupational education, adult education and remedial education. Some of his suggestions are:

1. To teach several levels of physics courses;
2. To remake the image of physics;
3. To devote the major portion of instruction time and effort to

courses for non-scientists;

4. To improve the image of two-year college physics teachers.
5. To improve communication between high-school, four-year college; university and community college instructors;
6. To develop explicit objectives for physics₇ courses and the necessity to make these objectives reasonable."

In 1970 the American Association of Physics Teachers started a group called the Committee on Physics in Two-Year Colleges (CPTYC). Dr. Herbert D. Peckham, Chairman of this committee, wrote a report on the first year of activities of this group. In it he discusses the objectives of the group and the projects they would like to undertake. Their objectives are the progress and innovation of physics teaching at the two-year college. Some of the mentioned projects are modular approaches to science education and the implementation of the computer as educational facility.⁸

The CPTYC held a meeting in October 1973 in Dallas. In a report about this meeting Dr. Peckham submitted the following information to this study:

- a. Almost all two-year colleges offer a physics sequence (three semesters or 5 quarters) for the majors track. This requires a concurrent course in calculus and serves science and engineering majors. At the larger community colleges, this course is always taught by teachers trained primarily in physics. At the smaller colleges, mathematicians, engineers, physicists, or chemists often teach the course.
- b. A second course sequence that is almost always offered is a non-calculus based course for pre-professional (medicine, pharmacy, law, medical technicians, etc.) students. Generally, trigonometry is required as a pre-requisite. The same generalizations about teachers made above apply here. The sequence is usually two semesters or three quarters long.
- c. A large number of two-year colleges offer a one-semester or one-quarter survey physics course that is intended to satisfy the general education science requirement. The mathematics

requirements are either non-existent or minimal. Almost any of the science faculty can and are assigned to teach the course.

- d. Most two-year colleges offer some type of physical science survey course. However, they are of such wide variety and organization that no generalizations can be made.
- e. A significant fraction of the two-year colleges offer a technical physics program. This serves students primarily in the two-year vocational programs and may be taught by either physics or vocational faculty members."

PHYSICS TEACHER PREPARATION

The American Journal of Physics shows a nationwide survey of two-year college physics teacher preparation done by Byrd and Adler of East Carolina University in 1970. They sent a questionnaire to each of the 978 institutions listed in the Directory at that time. There were 898 Junior Colleges and 79 Technical Institutions. They studied each of these institutions separately. Their response for Junior Colleges was 46% and for Technical Institutions was 52%. The overall response was 49%.

The questionnaire had eight items concerning experience, undergraduate and graduate training, adequacy of training in specific fields, desired level of additional training, and degree preference. Some of their results of most interest to this study were that over one-third of the Junior College respondents had more than 32 undergraduate credits in physics while 6% had less than 10. Of the Technical Institution respondents, 29% had between 10-16 credits, 24% had over 32 credits and 12% had less than 10. The majority of the instructors in both Junior Colleges and Technical Institutions felt well-prepared in Classical Mechanics,

Modern Physics, Electricity and Magnetism, Thermodynamics and Optics. Over one-half the Junior College instructors indicated they would like to receive first-year graduate courses as additional training. Less than one-third indicated they wanted to take junior-senior level courses. The Technical Institution respondents were equally divided between desiring junior-senior level courses or first-year graduate level courses as training.

In conclusion Byrd and Adler wished they had obtained more information on degrees held, areas of teaching, responsibilities, teaching load, and a more detailed inquiry of the relationship between graduate hours of preparation in physics and undergraduate hours. They suggested a more comprehensive follow-up survey be made. In 1970 Dr. A. A. Strassenburg of the University of New York at Stony Brook conducted and published a survey of two-year college physics department chairmen on their degree preference for the physics instructor. The study was restricted to New York. Thirty out of 40 responded. Of 148 total faculty in these 30 schools, 112 held Masters' degrees (66 of those were in physics), 27 held PhD degrees (22 of those were in physics). That fall there had been a total of 15 faculty members added in the 30 schools. Of these 15, 4 held PhD degrees and the rest had masters degrees. Eleven of the 15 degrees were in physics. Dr. Strassenburg noted in the report of his study that Junior College physics teacher preparation should include a large variety of broadening courses and experience. Graduate level courses should be included but these did not have to go beyond what is considered beginning graduate courses.¹¹

Dr. Strassenburg's study was more concerned with the level of preparation (Master's, PhD) than the specific field of preparation although he did point out the number of faculty members that had physics department degrees and the need for broadening experiences aside from physics. It would have been of interest to this study to know the specialty field of the other faculty members.

CHAPTER III

PROCEDURE

TWO-YEAR INSTITUTIONS INVOLVED IN STUDY

The population for this study consisted of all institutions listed in the Community and Junior College Directory of 1973. There are 1141 institutions listed. The sample consisted of ten percent of the population--114 schools. It was drawn randomly from the Directory, and stratified into three categories according to the enrollment of the institution. The three categories were:

- 1) institutions with enrollment under 1000
- 2) institutions with enrollment of 1000-3000
- 3) institutions with enrollment over 3000

Stratification made it possible to analyze the data according to differences in the institutions' physics curriculum and teacher qualifications. An equal number of institutions (38) were drawn from each category. The actual distribution of schools in the Directory is 470 in the under 1000 category, 410 in the 1000-3000 category, and 260 in the over 3000 category.

METHOD

The Community Junior Colleges were studied through a questionnaire mailed to them. Each questionnaire was accompanied by a cover letter addressed to Physics Department Head and signed by Dr. R. K. James and the author. There was no way of knowing the instructor's name to make this letter more personal. A stamped self-addressed envelope was en-

closed for the return of the completed questionnaire. These were sent out on September 26, 1973 and asked to be returned by October 10. On October 20 a reminder card was sent out to all non-respondents. Finally, on November 28 a second letter was sent out to all non-respondents including a second copy of the questionnaire and a stamped self-addressed envelope. A copy of the results was offered to the respondents. A total return of 80 questionnaires or 70% was achieved. Of these, 20% indicated they would like a copy of the results.

THE QUESTIONNAIRE

The questionnaire was designed by the author with the help of Dr. R. K. James (College of Education, KSU), Mr. R. Workman (G.R.A., Physics Dept., KSU), and a questionnaire designed by Dr. J. D. Spangler (Physics Dept., KSU) for a similar study. A copy of the questionnaire used in this study is included in the Appendix #1. It consisted of two parts: the first part dealt with courses offered and teaching style; the second part dealt mainly with teacher preparation. There was a total of 23 questions--2 completion questions and the rest were multiple choice.

In the first part each physics course offered was listed. Then for each of these, a few questions were asked about it so it could later be categorized into either Engineering Physics, General Physics, Technical Physics, or Physical Science. One of the most important questions in helping categorize was the math level it required. The other questions were related to the operational definition of each course given earlier

and it could have led occasionally to some disagreement between the respondents and researcher's definitions. The questions concerning teaching styles asked for number of lectures per week, time spent in discussion sessions, time spent in the laboratory, and whether or not it was required to do laboratory work. These questions were asked for each course.

The second part of the questionnaire inquired about the instructor's duties and preparation. He was asked what courses besides physics he taught, what physics courses and courses in related fields he had taken and considered most necessary or at least helpful, and what kind of degree he thought a physics instructor at a Community College should have. The instructor was also asked whether a two-year college physics teacher should have high-school teaching experience, if they and the students had access to a computer in the school, if its use was taught in the courses, and the rough percentage of students taking physics courses who were planning to transfer and those who were terminating at the Community College. The last question asked for the school's total enrollment; in a few cases the respondents' answer did not coincide with the cited enrollment in the Directory. When this occurred, the institution was classified according to the enrollment size given by the respondent and not by the Directory.

CHAPTER IV

RESULTS

As mentioned in the preceeding chapter a total of 70% (80) of the participating schools responded. Of the 80 responses, 30 came from institutions with enrollments over 3000, 24 from schools with enrollments of 1000-3000 and 26 came from schools with less than 1000 enrollment. Throughout the rest of this study, schools of under 1000 enrollment will be referred to as small, those of 1000-3000 enrollment as middle size, and those of over 3000 as large.

The answers to the questionnaire were compiled and grouped into seven tables. Each table deals with a different part of the questionnaire and shows the fraction of respondents that chose each of the possible answers to a given question. All results were expressed separately for each school category to allow for comparisons between these size categories, but the total results were also compiled for all responding schools.

Table I shows the number of institutions under each enrollment category which offers a particular course. The last column presents the total number of schools that teach the course. Also included are those institutions offering more than 1 course of a given type, i.e. a sequence; so, for example 37 out of 80 Junior Colleges teach 1 or more courses in General Physics.

It is interesting to note that 15%(4/26) of the small Junior Colleges do not offer physics courses. Therefore, a total of 5%(4/80) of

the responding institutions do not offer physics as part of their curriculum.

From Table I one can see that Engineering Physics and General Physics are the most frequently taught courses at these two-year institutions. Engineering Physics is taught in 66%(53/80) of the responding schools and General Physics in 77%(62/80). The variation in this figure is shown by the fact that 86%(26/30) of the large schools offer Engineering Physics while only 42%(11/26) of the small schools teach it. General Physics is taught in 53%(14/26) of the small community colleges as opposed to 93%(28/30) of the large ones. In the middle size junior colleges, 66%(16/24) offer Engineering Physics and 83%(20/24) offer General Physics.

Next in order of most commonly offered physics courses comes Physical Science. It is taught in slightly over half of the responding institutions. The breakdown indicates it is offered in 76%(23/30) of the large schools, 46%(11/24) of the middle size schools and 34%(9/26) of the small ones.

The respondents indicate that Technical Physics courses are the least common courses at the Community College Physics Departments. They are only offered on 35%(28/80) of all responding schools and 30%(24/80) of the remaining ones say they don't think such a course will be offered by them in the next two years. A small fraction of the Junior Colleges (8-80 or 10%) think they might add this type of course in the near future and 5%(5/80) didn't know. When divided into school enrollment categories, Technical Physics is offered at 23%(6/26) of the small

TABLE I
TYPES OF PHYSICS COURSES OFFERED AT THE 2 YEAR COLLEGES

	Small	Middle Size	Large	Total
Questionnaires answered	26	24	30	80
Engineering Physics	11	16	26	53
Indicated offering a sequence	3	9	20	32
General Physics	14	20	28	62
Indicated offering a sequence	6	11	20	37
Physical Science	9	11	23	43
Indicated offering a sequence	4	4	6	14
Technical Physics	6	9	13	28
Indicated offering a sequence	1	8	10	19
Technical Physics course might be added to curriculum	2	3	3	8
Technical Physics course probably won't be added to curriculum	8	10	6	24
Don't know whether course in Technical Physics will be added to curriculum	2	1	2	5
Physics not offered	4	-	-	4

institution, 35%(9/24) of the middle size schools and 44%(13/30) of the large ones. These data must be interpreted in the light of the fact that a number of institutions called "Technical Institutes" were in the population from where the sample was drawn.

These data also show for every type of physics course that the larger the enrollment of the institution the greater the proportion of schools offering the course. For example, Engineering Physics is offered at 42%(11/26) of the small schools, 66%(16/24) of the middle size schools, and at 86%(26/30) of the large ones. Likewise, General Physics is offered at 53%(14/26) of the small institutions, 83%(20/24) of the middle size ones and 93%(28/30) of the large ones. For Physical Science the proportions are 34%(9/26), 46%(11/24) and 75%(23/30) respectively. Finally, for Technical Physics the proportions also rise with school enrollment (23%(6/26), 35%(9/24), and 44%(13/30) respectively).

Some uncommon physics courses were mentioned. Two of the large Junior Colleges offer Radiologic Physics. One of these also offers Respiratory Physics. The math level of these courses (algebra and trigonometry) is the same as that of General Physics. They have an accompanying laboratory. Modern Physics (classified as Engineering Physics) is offered in one of the large Junior Colleges. This is only a lecture course and quite common at the four-year college. Other courses mentioned at two large institutions were Independent Study and Special Studies in Physics. The only information provided on these are that the latter requires laboratory work. One school in the middle-size category teaches three Technical Physics courses--two of which are called Physics for

Firemen and Physics for TV Repairmen. One large institution offers a self-paced Technical Physics course. In three of the large community colleges, Technical Physics courses are handled outside the Physics Department.

Table II shows the percentage of students planning to transfer taking physics at the Community Colleges. This question may have been misinterpreted sometimes and only 69 out of 80 responses were usable. The first item on the left column is the number of usable responses for each school category. The following items on that column are the four possible classifications of percentage of transfer students taking physics at the school. For example, 6/19 small institutions have under 33% transfer students taking physics.

TABLE II

NUMBER OF TRANSFER STUDENTS TAKING PHYSICS COURSES

	Size of School			Total
	Small	Middle size	Large	
Usable responses	19	21	29	69
% transfer students taking physics				
under 33%	6	4	8	18
34% - 50%	-	-	5	5
51% - 70%	5	2	5	12
over 70%	8	15	11	34

About half of the Community Colleges reported over 70% of the students taking physics as transfer students. A majority (72%(15/21)) of

the responding middle size institutions indicated having over 70% physics students planning to transfer. Also in this enrollment category 19%(4/21) Junior Colleges reported having under 33% physics transfer students. The large schools have the highest distribution of transfer students taking physics. In these Junior Colleges 28%(8/29) have under 33% transfer students in their physics courses, 17%(5/29) have 34%-50%, 17%(5/29) have 51%-70% and 38%(11/29) have over 70%. This is quite different from the middle size school distribution. In the small Junior Colleges, 42%(8/19) have over 70% transfer physics students, 26%(5/19) have 51%-70%, and 32%(6/19) have under 33% transfer physics students. In the 34%-50% classification there are no reports.

If 26%(18/69) of all respondents have under 33% of their physics students as transfer students and 7%(5/69) have from 34%-50% transfer students in their physics courses, only a third of the Junior College Physics Departments deal with groups of students of which at least 50% have non-professional interests. It is not surprising that only 35% of the institutions teach Technical Physics.

It is apparent that instructors at Junior Colleges should be aware of programs to which their students will transfer on completion of their programs. The upper half of Table III compares the lecture and discussion session teaching styles in each school category and for each type of course. The four types of courses are the main divisions. Under each type of course is a sub-division according to school size. The first item on the left column indicates number of schools under each size category that offer the course. For instance--20 middle size schools offer General Physics.

The data from Table III show that the teaching styles of every school size agree closely within each type of course, and in some cases the teaching style of all courses is very similar.

Lectures seem to be the usual mode of instruction. The number of Junior Colleges giving 3 lectures per week in all courses range from 50%(3/6)-71%(20/28). The schools offering more than 3 lectures per week in all courses and school size categories range from 21%(6/28)-37%(6/16). The number of institutions teaching Technical Physics and Physical Science that offer less than 3 lectures per week range from 9%(1/11)-38%(5/13). But in the schools teaching Engineering and General Physics, less than 3 lectures per week are given in only 5%(1/20)-11%(3/26) of the cases.

Discussion sessions are widely used except in Physical Science courses where 23%(10/43) of the Junior Colleges do not hold them. They are not offered at 7%(2/28) of the schools teaching Technical Physics, 4%(3/62) of the schools teaching General Physics and 3%(2/53) of the institutions teaching Engineering Physics.

At the schools offering Engineering and General Physics, discussion sessions of 1-2 hours a week are held in 43%(6/14)-65%(17/26) of the cases. In Technical Physics courses, 1-2 hour discussion sessions are held in 61%(8/13) of the large schools, 67%(6/9) of the middle size schools and only in 33%(2/6) of the small schools. For Physical Science courses 1-2 hour discussion sessions are given in 13%(3/23)-45%(4/9) of the Junior Colleges of all sizes.

The number of Junior Colleges offering discussion sessions of 3-5 hours a week range from 2%(1/43) of those teaching Physical Science to 11%

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TABLE III

METHODS : LECTURES, DISCUSSIONS, AND USE OF COMPUTER

(Code - S = Small, MS = Middle Size, LG = Large, T = Total)

	Engineering Physics					General Physics					Technical Physics					Physical Science												
	S		MS		LG		S		MS		LG		S		MS		LG		S		MS		LG		T			
	11	10	9	8	7	6	14	20	28	62	6	9	13	62	9	11	23	43	9	11	23	43	9	11	23	43		
Questionnaire item # 7	# Schools offering																											
	No lectures																											
	Less than 3 per week																											
	3 per week																											
	More than 3 per week																											
Questionnaire item # 8	No time allotted to discussion sessions																											
	1-2 hours per week																											
	3-5 hours per week																											
	Time allotted to discussion sessions depends on instructor																											
	Desk top programmable calculator available to faculty and students																											
Questionnaire item # 15	Will get a programmable calculator in the next year																											
	Computer sophisticated enough for physics offerings																											
Questionnaire item # 16	Use of calculator taught in class																											
	Use of computer taught in more advanced courses																											

(6/53) of those teaching Engineering Physics.

The instructor can determine the time allotted to discussion sessions in about a third of the schools of any size and for any course.

The lower half of Table III has information on the availability of programmable calculators. These data attempt to determine whether the students are exposed to more modern methods of solving the problems and dealing with the math encountered in the physics courses as opposed to long-hand solutions or even slide rule. They deal with relatively simple systems and have nothing to do with computer programming per se.

Item 15 of the questionnaire asked if there is a programmable calculator in the department available to the instructors and students. The results show that except in the case of Engineering Physics, the bigger the school the more often there is one available. The biggest difference in calculator availability is in Technical Physics courses where 62%(8/13) of the large institutions have them as opposed to 17%(1/6) of the small schools. None of the small Junior Colleges are planning to obtain one but from 11.5%(3/26)-23%(3/13) of the 2 higher enrollment schools will get one in the next year. In at least 93% of the cases the computer is sophisticated enough for the courses taught.

At the large institutions the use of the computer is taught in all courses in 50%(8/16)-56%(9/16) of the cases. In the middle category this is true in 25%(3/12)-50%(3/6) of the schools. In the small schools the use of the programmable calculator is only taught in Engineering and General Physics courses in 16%(1/6)-33%(1/3) of the cases.

In summary, the information of Table III indicates that the main teaching style in all physics courses at the Community Colleges is 3 lectures and 1-2 hour discussion sessions per week. Also half the institutions have programmable calculators available and its use is implemented more in the large Junior Colleges.

The information on Table IV refers to the emphasis placed on laboratory work in each type of physics course and for each school category. The main horizontal divisions and subdivisions are identical to those on Table III. Again the results indicate that the teaching style is very similar among the three school size categories. The only courses that have optional laboratory work are Physical Science and Technical Physics in a few schools (11%(5/43) and 18%(5/28) of the Junior Colleges respectively). An exception to this is one Engineering Physics course (2%(1/53) of the schools offering this course). Item 10 in the questionnaire that says "no time allotted to lab work" was chosen by 44%(10/23 and 4/9) of the large and middle size institutions teaching Physical Science and by 15%(2/13) of those teaching Technical Physics. This item was sometimes also chosen by Junior Colleges that offer optional laboratory work as well as Junior Colleges that do not offer any laboratory work for a given course.

In all Community Colleges the majority of the courses require 2-4 hours per week in the laboratory. Very few schools require 4-6 hours per week in the laboratory. The number of institutions with this requirement do not exceed 6%(3/53) of those offering Engineering Physics, 6%(4/62) of those offering General Physics or 7%(2/43) of those teaching Physical Science. Laboratory work is mainly graded on a letter basis. At least

50% of the Community Colleges in any size category give letter grades for laboratory work. The highest incidence of Pass-Fail grading is found in 12%(3/24) of schools offering Technical Physics. One institution in the middle size category mentioned grading laboratory work on the basis of points. Schools that do not grade laboratory work do not exceed 11%(3/27, 2/24, 1/62, 4/53) for any course.

The laboratory instructor is the lecture instructor for a given course in at least 93% of the institutions.

It can be concluded from Table IV that most physics courses require 2-4 hours of laboratory work per week. The work in the laboratory is supervised by the lecturer of the corresponding course, and is graded on a letter basis.

Table V attempts to compare teaching assignments of non-physics courses among the physics instructors at the Junior Colleges. In this table more than one answer per question is possible. The data indicate that the majority of the physics faculty teaches courses besides physics. Item 18 shows that math is taught by 46%(35/76) of the instructors, Chemistry by 16%(12/76), Life Sciences by 6%(5/76), and "Other" was chosen by 16%(12/76). Among the size categories, Math is taught by similar proportions of instructors in all school categories (40%(12/30), 42%(10/24), 59%(13/22). Chemistry is taught more often by small school instructors (23%(5/22) as opposed to 12%(3/24 and 4/30) in the larger schools.) Life Sciences is taught slightly more often by the small school physics instructor than the larger school physics instructor (9%(2/22); in small schools, 4%(1/24) and 6%(2/30) in larger schools). In the larger schools 37%(9/24 and

TABLE V
NON-PHYSICS TEACHING ASSIGNMENTS

		Small	Middle-size	Large	Total
# of usable responses		22	24	30	76
Questionnaire item #18	Courses other than Physics taught by physics instructor :				
	Math	13	10	12	35
	Chemistry	5	3	4	12
	Life Sciences	2	1	2	5
	Other	4	3	5	12
	None	4	9	11	24
Questionnaire item #19	Occupational Skills :				
	Computer Programming	2	1	7	10
	Engineering or Industrial Technology	6	6	4	16
	Electronics	5	6	2	13
	Other	1	1	-	2
	None	11	13	18	42

11/30) of the instructors do not teach courses outside of Physics. In the small Junior Colleges this is true for 18%(4/22) of the physics teachers.

Item 19 lists some occupational skills (Computer Programming, Electronics, and Engineering or Industrial Technology) and asked the instructors to indicate those they teach. The highest number of instructors teaching Computer Programming is in the large school category (23%(7/30)). Overall this skill is taught by 13%(10/76) of the instructors. The small and middle size school category has the highest number of instructors teaching Engineering or Industrial Technology and Electronics(23%(5/22)-27%(6/22)). The total number of instruc-

tors teaching Engineering or Industrial Technology is 21%(16/76) and the total number of instructors teaching Electronics is 17%(13/76). At least half the instructors in every school category do not teach any occupational skills. The data from the previous table says that the course besides Physics most often taught by the physics instructor is Math (about half the respondents teach it), and in a few of the schools (a fifth or less) physics faculty teach either Chemistry, Engineering Technology or Electronics.

Table VI reveals the degree preferences and teaching experience opinions among the physics teachers. Item 20 indicates that the physics degree is favored by slightly over half the instructors (54%(41/76) and "Either of the above" (Physics, Physics Education, Physical Science) by a third 33%(25/76). A majority of the large and middle size school instructors (60%(18/30)-62%(15/24)) prefer the physics degree while a small majority of the small school instructors 41%(9/22) prefer "Either of the above".

Item 21 asked whether the physics instructor should have high school teaching experience. The results indicate that 44%(34/76) disagree and 28%(22/76) agree with the statement, and 26%(20/76) are undecided. When these results are separated into school size categories, a minority of the large school instructors agree with the statement (6%(5/76)), while almost an equal number of teachers agree and disagree in the small and middle size categories.

From Table VI it can be concluded that more teachers consider the physics degree appropriate to be a Junior College physics instructor than the Physical Science or Physics Education degree. Also less than a third

TABLE VI

INSTRUCTOR PREFERRED DEGREES, HIGH SCHOOL TEACHING EXPERIENCE OPINIONS

	Small	Middle Size	Large	Total
# of usable responses	22	24	30	76
Questionnaire Physics instructor item #20 should have degree in :				
Physical Science	4	4	1	9
Physics Education	2	2	-	4
Physics	8	15	18	41
Either of the above	9	5	11	25
 Questionnaire Physics instructor item #21 should have high school teaching experience :				
Strongly Agree	2	3	1	6
Agree	6	6	4	16
Undecided	7	7	6	20
Disagree	6	6	10	22
Strongly Disagree	1	2	9	12

of the faculty think the Junior College physics instructor should have high school teaching experience.

The course or formal preparation of the physics instructor is presented in Table VII of a list of courses in physics and other areas the respondents indicated those which they have taken, those considered necessary background, helpful background and unnecessary background.

The physics courses in the list, which occupy the first half of the left column have been taken by at least two-thirds of the teachers. A few exceptions are Advanced Physics Laboratory which has been taken by 58% (44/76) Solid State Physics and Theoretical Physics which have been taken

by slightly over one-third of the instructors and Technical Physics courses, taken by less than one-third of the physics faculty. Most of the physics courses in the list would normally be taken by undergraduate physics majors. As expected, the physics courses labeled as "Necessary" by at least one-third of the respondents are those courses which are most basic to the knowledge of the field. These are Modern Physics, Thermodynamics, Optics, Mechanics, Electricity and Magnetism, and Nuclear Physics. The physics courses not classified as "Necessary" were usually classified as "Helpful". The few physics courses considered unnecessary by more than one teacher but less than one-third of the instructors were Technical Physics, Advanced Physics Laboratory, Quantum Mechanics, Astronomy, Solid State Physics, and Theoretical Physics.

The courses other than Physics in the list are courses in Math, Engineering, Education and other science areas. Of the courses in other science areas (Geology, Meteorology, Chemistry, Biology, etc.), at least one-third of all instructors have taken the Introductory and Advanced Chemistry courses and the Introductory Biology courses. The Geology and Meteorology courses have been taken by less than one-third of the physics teachers. These two courses were considered helpful rather than necessary. The Chemistry and Biology courses were also classified as "Helpful" rather than "Necessary". Advanced Biology was generally considered unnecessary.

The Math courses (Computer Programming, Calculus, Differential Equations, Applied Math, etc.) have been taken by about one-half of the instructors and were classified as "Necessary except for Computer Programming" which was considered more often "Helpful" than "Necessary" and has been

TABLE VII
TEACHER PREPARATION COURSES

76

Questionnaire # of Respondents
Item # 22

	HAVE TAKEN	NECESSARY	HELPFUL	UNNECESSARY
Physics courses :				
Modern Physics Laboratory	54	26	33	2
Advanced Physics Laboratory	44	22	21	7
Modern Physics	57	38	25	1
Technical Physics courses	18	13	26	13
Thermodynamics	48	38	23	2
Optics	49	38	21	1
Electricity & Magnetism	58	45	17	-
Mechanics	60	46	13	-
Quantum Mechanics	50	20	30	6
Nuclear Physics	50	25	31	4
Astronomy	31	9	33	8
Electronics	53	24	34	1
Solid State Physics	26	12	32	6
Theoretical Physics	29	11	29	10
Math courses :				
Computer Programming	27	14	31	8
Calculus	61	45	12	2
Differential Equations	37	31	20	7
Applied Math	37	19	21	5
Courses in other Science areas :				
Introductory Engineering courses	35	14	28	10
Advanced Engineering courses	22	3	28	16
Geology	20	4	24	22
Meteorology	16	2	22	18
Introductory Chemistry courses	58	15	41	4
Advanced Chemistry courses	33	1	38	14
Introductory Biology courses	35	11	28	28
Advanced Biology courses	10	-	19	28
Education courses : The Junior College	15	6	19	25
Junior College Curriculum	9	5	20	22
College Teaching	12	8	20	14

taken by about one-third of the faculty.

About half the instructors have taken Introductory Engineering courses. These are considered helpful rather than necessary. The Advanced Engineering courses were classified as "Helpful" and have been taken by less than one-third of all the instructors.

The last three courses on the list which are Education courses (Junior College, Junior College Curriculum, College Teaching) have been taken by less than a third of the instructors. These were considered either helpful or unnecessary, and only in a few cases were they considered necessary.

The data of Table VII show that most of the responding physics faculty have taken and consider necessary background to their teaching the physics and math courses mentioned. The introductory courses in Engineering, Chemistry and Biology (considered helpful background) have been taken by about half of the instructors. These data were not presented divided into the three school size categories because the physics teacher preparation was very similar among the categories. The only difference worth noting was that a few more small school instructors have taken the non-physics courses than instructors at the larger schools and about a third of them consider introductory Engineering and Biology courses necessary.

In summary, the results presented in this chapter are:

- 1) Engineering Physics and General Physics are offered at 66%(53/80) and 77%(62/80) of the Community Colleges respectively. Physical Science is offered at 53%(43/80) of the institutions. Technical Physics is taught

in 35%(28/80) of the Junior Colleges and 30%(24/80) of the respondents do not think this course will be incorporated into their curriculum. Only 10%(8/80) think Technical Physics might be added to their list of offerings. Physics is not offered at 5%(4/80) of the Junior Colleges all of which are small institutions. There is not a predominant type of physics course offered in a particular Junior College size category, but the larger the school the more comprehensive the physics curriculum.

2) At 66%(34/69) of the schools over half the physics students are planning to transfer to an institution beyond the Junior College.

3) The teaching style (lectures, discussion sessions) is very similar among the three school size categories. The most frequent pattern in all courses is 3 lectures and 1-2 hour discussion sessions per week.

4) About half the responding Junior Colleges have programmable calculators available. Sixty-three percent (19/30) and 54%(13/24) of the large and middle size institutions respectively have programmable calculators. However, they are available at only 23%(5/22) of the small schools. Their use is taught in at least half of the large institutions, a third of the middle size institutions in all courses, and in 16%-33% of the small schools in the Engineering Physics and General Physics courses.

5) Laboratory work is required at all Engineering Physics and General Physics courses, 89%(25/28) of the schools teaching Technical Physics and 63%(27/43) of the schools teaching Physical Science. The most frequent period of time spent in the laboratory in every course is 2-4 hours per week. Laboratory work is mainly graded on a letter basis. The Laboratory instructor is the lecture instructor in at least 93%(71/76) of the

institutions.

6) About half of the physics teachers teach courses other than physics in the Community Colleges. Math is taught by 46%(35/76) of the instructors, and it seems to be the most frequently taught course by the physics teacher at the Junior Colleges. The next most frequently taught course is Chemistry (16%(12/76)) and last comes Life Sciences (5%(5/76)). Occupational skills are also taught by the physics instructor. The most popular one is Engineering Technology (21%(16/76) of the instructors teach it). Electronics and Computer Programming are taught by 18%(13/76) and 13%(10/76) of the physics instructors respectively. About half of the physics instructors do not teach any occupational skills and about one-third do not teach any courses besides physics.

7) The physics degree is preferred by 54%(41/76) of the responding teachers. When divided into school size categories this degree was chosen by 60%(18/30), 62%(15/24) and 37% (8/22) of the teachers in the large, middle size and small schools respectively. A degree in either Physics, Physics Education, or Physical Science is favored by a third of the responding instructors, and by 41%(9/22) of the small school instructors. Only 12%(9/76) preferred Physical Science and 5%(4/76) preferred Physics Education. The teachers at the small and middle size Junior Colleges have equally divided opinions as to whether the Community College physics instructor should have high school teaching experience. The instructors at the large Junior Colleges disagree with the statement. Overall 45% (34/76) of the instructors disagree with it.

8) The preparation of the physics instructors is very similar. At least half the teachers have taken all the physics courses mentioned except for Technical Physics, Solid State Physics and Theoretical Physics. All of the physics courses are considered helpful if not necessary. In the list of math courses, Calculus and Differential Equations have been taken by more than half of the instructors and Applied Math and Computer Programming by less than half. These courses classified as "Necessary" except for Computer Programming which was classified as "Helpful". Introductory Chemistry courses, Introductory Engineering courses and Introductory Biology courses have been taken by one-third to a half of the instructors. The introductory courses are considered more helpful than the advanced courses in these other science areas. The Education courses have been taken by very few physics teachers and are not considered very helpful.

CHAPTER V

SUMMARY AND CONCLUSIONS

The results of this study can be summarized as follows:

- 1) General Physics and Engineering Physics are the most frequently taught courses at the responding Community Colleges. They are offered in 77% and 66% of the institutions respectively. Technical Physics courses are taught by 35% of the Junior College physics departments. In 3% of the institutions this type of course is taught outside physics departments. However, this type of course seems not to be gaining importance since only 10% of the responding colleges think Technical Physics will be added to the physics department curriculum. Physical Science courses offered in 53% of the Junior Colleges.

Physics is not taught in 5% of the responding schools, all of which are small schools (under 1000 enrollment).
- 2) The teaching style (lectures, discussion sessions) varies very little among the three school size categories studied, and even among the type of course. The most common pattern in all courses is 3 lectures per week and 1-2 hour discussion sessions per week. Programmable calculators are available at 63%, 54% and 23% of the large, middle size and small Junior Colleges respectively. Overall they are available at half the responding institutions. Their use is taught in at least 50% of the large schools, 33% of the middle size schools in all courses and in 16% of the small institutions in the Engineering Physics and General Physics courses. Laboratory

work, with one exception, is required in all schools teaching Engineering and General Physics. In Technical Physics courses it is required in 89% of the schools and in Physical Science courses it is required in 63% of the Community Colleges. In every course the most common period of time spent in the laboratory is 2-4 hours per week. Laboratory work is mainly graded on a letter basis. The laboratory instructor is the lecture instructor in at least 93% of the institutions.

- 3) The number of physics instructors teaching Math ranges from 40% at the large schools to 59% at the small ones, while those teaching Chemistry vary from 12% to 27% at the large and small schools respectively. The physics teacher instructs Life Sciences at 4% of the middle size schools while 9% of the small college faculty members have these duties. Of the middle size institutions 4% rely on the physics faculty to teach Computer Programming, with the number rising to 23% in the large schools. Engineering Technology is taught by a physics faculty member at 12% of the large schools, increasing to 27% in the small schools while only 6% of those in the large schools teach Electronics. Twenty-five percent of their middle size counterparts teach Electronics. Overall 13% of the physics instructors teach Computer Programming, 21% teach Engineering Technology and 17% teach electronics. About half the respondents do not teach any occupational skills.
- 4) The preparation of the respondents basically consists of most of the physics courses in an undergraduate physics major program at a

university, math courses up to the level of the more sophisticated physics courses and at least introductory courses in Chemistry, Engineering and Biology. The physics courses have been taken by about two-thirds of the instructors except for Technical Physics, Solid State, Theoretical Physics, Advanced Physics Laboratory and Modern Physics Laboratory. All the physics courses are considered at least helpful. Over 50% of the physics faculty has taken Calculus and Differential Equations and believe these are necessary. Computer Programming and Applied Math have been taken by one-third to one-half of the instructors and are considered more helpful than necessary. Introductory Chemistry courses have been taken by over two-thirds of the physics faculty. Introductory Engineering and Introductory Biology courses have been taken by one-third to one-half of the instructors. These beginning courses are believed to be more helpful to the physics teacher than the advanced courses in these areas. More instructors in the small and middle school size categories have taken courses in the science areas besides physics and consider these more necessary than the physics instructors at the large schools. The Education courses have been taken by about one-third of the physics teachers at the small schools and less than a third in the other schools. These are considered either helpful or unnecessary.

- 5) More than one-half of the instructors believe the Community College physics teacher should have a degree in physics (54%). When divided into school size categories, 60%, 62% and 37% of the teachers in the

large, middle size and small schools respectively agree with this. A degree in either Physics, Physics Education or Physical Science is favored by one-third of the teachers. Among the small Community College instructors 41% chose either degree. This is also true for 20% of the middle size school instructors and 36% of the large school instructors. A degree in Physics Education was chosen by 5% of all the teachers and a degree in Physical Science by 12%. Except for the physics instructors at the large Junior Colleges there are equally divided opinions as to whether the Community College physics instructor should have high school teaching experience.

- 6) At 26% of the Junior Colleges a majority of the physics students (over 66%) have primarily vocational goals, while at 66% of the institutions more than one-half of the physics students plan to transfer. The only observable difference among the three school size categories is types of physics courses offered, is that in the bigger schools the curricula are more comprehensive, that is they include courses of the four types studied. One does not see a predominant type of physics course for a certain school size. Therefore, one does not see a predominant type of student (either transfer or vocational) in a given school size.

The results of this study agree closely with the information provided by the CPTYC concerning Junior College Physics Curricula to the degree that comparisons can be made with their information since they didn't provide numbers. The CPTYC says that a "physics sequence" for engineering and science majors and another "physics sequence" for pre-professional

students is "almost always offered" at Community Colleges. The Committee also says that "a significant fraction" of two-year colleges teach Technical Physics. However, this study and the Committee disagree somewhat when it comes to Physical Science courses. The Committee says these are offered in "most two-year colleges", while this study's results say they are offered in 53% of the institutions.

Schrautemeier's suggestion "to devote the major portion of instructor time and effort to courses for non-scientists"¹² has not been implemented in the two-year colleges according to the information found in this study.

In comparing the physics teacher preparation results to the study conducted by Byrd and Adler, at least half the physics instructors in our survey must have 32 undergraduate physics credits or more according to the courses they indicated they had taken. In Byrd and Adler's study over a third of the Junior College respondents had more than 32 undergraduate physics credits. Also at least half the instructors in our survey had taken Mechanics, Modern Physics, Electricity and Magnetism and Thermodynamics. In Byrd and Adler's study the majority of the instructors felt "well prepared" in the mentioned fields.

CONCLUSIONS AND RECOMMENDATIONS

This study has provided much interesting and practical information to prospective Junior College physics instructors and to the Junior Colleges themselves. The main finding is that Junior College physics courses and teacher preparation are mainly oriented towards the transfer student. Therefore, two-year institutions of all sizes are predominantly composed of transfer physics students, although a few schools have majorities of vocational students. Technical Physics courses are not a growing interest in the Junior College Physics Department. Slightly over a third of the institutions offer these. In general the bigger the school the more comprehensive the curriculum.

Teaching styles of the physics courses are like those in the four-year colleges with the same emphasis placed on lectures, discussion sessions, and laboratory work as in the university physics courses. Programmable calculators are more popular in the bigger institutions.

Physics teacher preparation basically consists of a strong bachelors degree in physics and additional courses in Chemistry, Biology and Engineering. At least half the Community College Physics instructors teach courses besides physics--such as Math, Chemistry, Industrial Technology, or other related fields. High school teaching experience does not seem to be important to be a successful physics teacher at the Community College.

A summary of the results and the author's recommendations are presented below:

- 1) Potential Junior College physics teachers should place special emphasis on their physics preparation. It should not be less than a strong

bachelor's degree in the field and preferably a master's degree. Since the Community College Physics instructor can expect to teach courses outside his field, he could benefit from pursuing a double major in undergraduate school, such as Physics and Math or Physics and Chemistry; he would even benefit from taking a wide variety of science elective courses, without pursuing a double major.

- 1) Potential Junior College physics teachers should place special emphasis on their physics preparation.
- 2) The study has shown that the Community College Physics instructor can expect to teach the laboratory sections along with the lectures in the courses and to follow a teaching style very similar to that of the four-year college. Therefore, laboratory and lecture teaching experience while in graduate school would be valuable to the new physics instructor.
- 3) It was found that Technical Physics courses are not frequently offered nor are they a growing interest at the Junior Colleges; however, the Junior College Physics departments should place more effort in implementing the courses since the National Science Foundation is granting support to different groups to develop Technical Physics at the two-year colleges.¹³
- 4) Engineering Physics and General Physics courses are offered more frequently than Physical Science courses. In order to serve non-science students and the community in general (which is one of the functions of the Junior College), more two-year colleges should offer Physical Science courses.

It would be interesting to undertake these follow-up studies in a few years:

- a) A study to determine whether the Junior College Physics curriculum trends have changed from offering mostly Engineering Physics and General Physics to offering mostly Technical Physics and Physical Science.
- b) A study to determine whether the Junior College Physics instructors' teaching assignments in non-physical sciences have increased or decreased, and whether his formal preparation is still heavily oriented towards physics.
- c) A study to determine whether the Junior College Physics teaching methods have changed in their emphasis on lectures, discussion sessions and laboratory work.

FOOTNOTES

¹A. Connor, S. Howe, K. Davis, Eds., Community and Junior College Directory, Washington D.C., 1972, p.7.

²Roger B. Solomon, "An Open Letter to a Community College Freshman and his Parents", Peabody Journal of Education, Vol. 45, #4, January 1968, p. 205-208.

³John Lombardi, "Tuition and the Open Doore", Junior College Journal, Vol. 42, #8, May 1972, p. 9.

⁴James W. Reynolds, The Comprehensive Junior College Curriculum, (Berkely: McCutchan Publishing Company, 1969), p. v.

⁵John D. Spangler, Questionnaires answered by Kansas Junior College Physics instructors, work unpublished.

⁶Bill G. Aldridge, "Physics in the Open Door College", Physics Today, March 1970, p. 46-51.

⁷E. Schrautemeier, Physics Education in the Community College, Paper presented at winter meeting of the AAPT, San Francisco, California 1972, Research in Education, (ERIC EDO64060).

⁸H. D. Peckham, Committee on Physics in the Two-Year Colleges--The First Year, Gavilan College, Gilroy, California, 1972, Research in Education (ERIC EDO64059).

⁹Committee on Physics in Two-Year Colleges, Report on Dallas meeting, October 1973, p. 7.

¹⁰C. G. Adler, J. W. Byrd, "A Profile of the Two-Year College Physics Teacher", American Journal of Physics, Vol. 39, #11, November 1971, p. 1302-1306.

¹¹A. A. Strassenburg, "College Physics Teacher--How Do It?", American Journal of Physics, Vol. 39, #11, November 1971, p. 1307.

¹²E. Schrautemeier, loc.cit.

¹³Philip Dilavore, Physics of Technology: A Report of the Tech Physics Project, Terre Haute, Indiana, 1973.

14. Strassenburg, A. A., College Physics Teacher--How Do It?, American Journal of Physics, Vol. 39, 11:1307-1310, November 1971.
15. Thornton Jr., James W., The Community Junior College, Third Edition. New York: John Wiley & Sons, Inc., 1972.

BIBLIOGRAPHY

1. Adler, C. G., and J. W. Byrd, A Profile of the Two-Year College Physics Teacher, American Journal of Physics, Vol. 39, 11:1302-1306, November 1971.
2. Aldridge, Bill G., Physics in the Open Door College, Physics Today, Vol. 42:46-51, March 1970.
3. Committee On Physics in Two-Year Colleges, Report on Dallas Meeting.
4. Connor, A., S. Howe, and K. Davis, (Eds) Community and Junior College Directory, Washington D.C., 1972.
5. Dilavore, Philip, Kelly, W., and Leslie, Wilbur, Teaching in the Community Junior College. New York: Appleton Century Crafts, Educational, Meredith Corporation, 1970.
6. Lombardi, John, Tuition and the Open Door College, Junior College Journal, Vol. 42, 8:8-11, May 1972.
7. National Education Association, Research Division, Faculty Load Policies and Practices in Public Junior and Community Colleges. Research in Education, (ERIC ED070429), March 1972.
8. O'Banion, Terry, Staff Development Priorities for the Seventies, Community and Junior College Journal, Vol. , :10-11, October 1972.
9. Peckham, H. D., Committee on Physics in Two-Year Colleges--The First Year. Gavilan College, Gilroy, California, Research in Education, (ERIC ED064060), 1972.
10. Reynolds, James W., The Comprehensive Junior College Curriculum. Berkely: McCutchan Publishing Corporation, 1969.
11. Schrautemeier, E., Physics Education in the Community College. Paper presented at the Winter meeting of the AAPT, San Francisco, California, Research in Education, (ERIC ED064059), 1972.
12. Solomon, Roger B., An Open Letter to a Community College Freshman--and his Parents, Peabody Journal of Education, Vol. 45, 4:205-208, January 1968.
13. Spangler, John D., and W. C. Kitchen, Cooperative Projects for Two-Year Colleges. Interim Report to National Science Foundation, College Science Improvement Program, 1972.

APPENDIX

PART I

Choose the answer that best fits each course

1. List in the space provided at the right, the physics department courses offered for the last two years in the order of most basic to most sophisticated. List the courses and their corresponding laboratories together. (Remember, choose the answer that best fits each course)

(From question 2 on for part I, fill only the appropriate letter for each course)

- | | COURSES | | | | | | | | | |
|--|---------|--|--|--|--|--|--|--|--|--|
| 2. Math pre-requisite or corequisite
a. high-school algebra b. algebra and geometry c. calculus | | | | | | | | | | |
| 3. In this course, developing the ability to derive equations is very important.
<u>Strongly agree</u> <u>Agree</u> <u>Undecided</u> <u>Disagree</u> <u>Strongly Disagree</u>
a b c d e | | | | | | | | | | |
| 4. In this course, developing problem solving skills is very important.
<u>Strongly Agree</u> <u>Agree</u> <u>Undecided</u> <u>Disagree</u> <u>Strongly Disagree</u>
a b c d e | | | | | | | | | | |
| 5. In this course, learning industrial applications of the concepts taught is very important.
<u>Strongly Agree</u> <u>Agree</u> <u>Undecided</u> <u>Disagree</u> <u>Strongly Disagree</u>
a b c d e | | | | | | | | | | |
| 6. In this course, gaining conceptual understanding is very important
<u>Strongly Agree</u> <u>Agree</u> <u>Undecided</u> <u>Disagree</u> <u>Strongly Disagree</u>
a b c d e | | | | | | | | | | |
| 7. Lecture sessions per week
a. none b. less than 3 c. 3 d. over 3 | | | | | | | | | | |
| 8. Time per week allotted to discussion or problem sessions
a. none b. 1-2 hours c. 3-5 hours d. depends on instructor | | | | | | | | | | |
| 9. The laboratory work in this course is
a. optional b. required | | | | | | | | | | |
| 10. Hours per week usually spent in the laboratory
a. none b. 2-4 c. 4-6 d. over 6 | | | | | | | | | | |
| 11. Laboratory work in this course is graded
a. on a letter basis (A,B,C,etc) b. on a pass-fail basis
c. it is not graded | | | | | | | | | | |
| 12. In this course, the laboratory is taught by
a. the lecture instructor b. another physics instructor
c. a student d. other | | | | | | | | | | |

PART II

13. Of the total student population taking physics courses, roughly what percentage is composed of transfer students, what percentage of vocational students, and what percentage of students with no degree goal beyond the two year program?
- a. Transfer _____ %
b. Vocational _____ %
c. No degree goal beyond 2 years _____ %

Mark or circle appropriate answer

14. If a Technical physics course isn't offered at the present, will one be incorporated into the curriculum in the next two years ?
a. yes b. probably so c. don't know d. I didn't think so e. no
15. Is there a desk top programmable calculator computing system available to the physics instructor and the students ?
a. yes b. no c. not at present, but we are planning on obtaining one in the next year.
(if answer no, go to #18)
16. Is the system sophisticated enough for the courses being offered ?
a. yes b. no
(if answer no, go to #18)
17. Is there class time set aside devoted to teaching the use of the computer ?
a. yes b. no c. in the more advanced courses.
18. What courses besides physics are usually taught by the physics instructor ?
a. none b. math c. chemistry d. life sciences e. other
19. Which of these occupational skills are usually taught by the physics instructor ?
a. computer programming b. engineering technology or industrial technology
c. electronics d. other e. none
20. In your opinion, a Junior College physics instructor should have a degree in
a. Physical Science b. Physics Education c. Physics d. either of these
21. The Junior College physics instructor should have high-school teaching experience
Strongly Agree Agree Undecided Disagree Strongly Disagree
a b c d e
22. Catalog the following courses as to how necessary a background they are to your teaching. Add others if consider appropriate.

	<u>Have taken</u>	<u>Necessary</u>	<u>Helpful</u>	<u>Unnecessary</u>
Modern Physics Laboratory.....				
Advanced Physics Laboratory....				
Modern Physics.....				
Technical Physics courses.....				
Thermodynamics.....				
Optics.....				
Electricity and Magnetism.....				
Mechanics.....				
Quantum Mechanics.....				
Nuclear Physics.....				
Astronomy.....				
Geology.....				
Metereology.....				
Electronics.....				
Solid State Physics.....				
Theoretical Physics.....				
Computer Programming.....				
Calculus.....				
Differential Equations.....				
Applied Math.....				
Introductory Engineering courses				
Advanced Engineering courses...				
Introductory Chemistry courses.				
Advanced Chemistry courses.....				
Introductory Biology courses...				
Advanced Biology courses.....				
The Junior College.....				
Junior College Curriculum.....				
College Teaching.....				

23. Approximate enrollment(full and part time students) at institution
a. under 1000 b. 1000-3000 c. Over 3000

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A SURVEY OF JUNIOR COLLEGE PHYSICS
CURRICULA AND TEACHER PREPARATION

by

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AN ABSTRACT OF A MASTER'S REPORT

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The purpose of this study was to determine the types of physics courses most frequently offered at Junior Colleges throughout the country; the teaching styles practices in these courses; the non-physics teaching assignments of the physics instructors at these institutions; the formal preparation of the Junior College physics faculty; and the degree goal of the students enrolled in the physics courses.

The study was conducted through written questionnaire mailed to Junior College Physics Department Heads. One hundred and fourteen or ten percent of the institutions in the 1973 Community and Junior College Directory were randomly selected for the study. The participant schools were stratified into three categories according to their enrollment.

It was found that Engineering Physics and General Physics were the most frequently offered courses in the Junior Colleges. The larger schools tended to offer a wider variety of physics courses than the smaller schools. The teaching style in all physics courses was 3 lectures and 1 to 2 hours of discussion sessions per week. About half the schools had programmable calculators available. Laboratory work was required in the majority of the courses. This work was usually graded and taught by the lecturer of the course. The usual period of time per week devoted to the laboratory was 2 to 4 hours. Most of the students in the physics courses planned to transfer. Over half the Junior College physics faculty taught non-physics courses, such as math, chemistry, and engineering technology. Most of the physics instructors agree that the Junior College physics teacher should have a degree in the discipline. The formal preparation of the majority of the respondents was a thorough undergraduate physics background, a number of physics courses at the lower graduate level, and some additional courses in math, chemistry, engineering and biology.