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THE FEASIBILITY OF CONCURRENT ENROLLMENT OF HIGH SCHOOL  
STUDENTS IN COLLEGE-LEVEL INTRODUCTORY PLANT SCIENCE

by

Gregory H. Egan

A thesis submitted in partial fulfillment  
of the requirements for the degree

of

MASTER OF SCIENCE

in

Agricultural Education

UTAH STATE UNIVERSITY  
Logan, Utah

1989

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Gregory H. Egan

## TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS . . . . .	ii
LIST OF TABLES . . . . .	vi
ABSTRACT . . . . .	vii
Chapter	
I. INTRODUCTION . . . . .	1
Background . . . . .	1
Future Trends . . . . .	2
Statement of Problem . . . . .	3
Specific Purpose . . . . .	4
Research Questions . . . . .	4
Limitations . . . . .	4
Definition of Terms . . . . .	5
Advanced Studies . . . . .	5
Articulation . . . . .	5
Concurrent Enrollment	5
"Introduction to Agricultural Plant Science"	
(Plant Science 100) . . . . .	6
II. REVIEW OF LITERATURE . . . . .	7
Background . . . . .	7
Articulation . . . . .	8
Advanced Studies . . . . .	11
Program Implementation . . . . .	13
Significant Findings . . . . .	14
III. METHODOLOGY . . . . .	18
Population . . . . .	18
Sampling Procedure . . . . .	18
Program Recruitment . . . . .	19
Data Collection . . . . .	19
Validation of the Study . . . . .	20
Analysis . . . . .	21
IV. RESULTS AND DISCUSSION . . . . .	22
Background . . . . .	22
Descriptive Information . . . . .	22

Grade Level of High School Participants . . . . .	22
Grade Level and Number of College Participants . . . . .	23
High School GPA of College and Concurrent Enrollment Participants . . . . .	24
Agricultural Background . . . . .	24
Reason for Taking the Course . . . . .	24
Summary of Descriptive Data . . . . .	24
Research Question 1 . . . . .	27
Summary of Pass/Fail at 70% Level . . . . .	27
Comparison of Pass/Fail Student Grade Point Averages (GPAs) . . . . .	27
Summary of Research Question 1 . . . . .	27
Research Question 2 . . . . .	28
Grade Point Average . . . . .	28
Quiz Comparisons . . . . .	28
Exam 1 Comparisons . . . . .	29
Exam 2 Comparisons . . . . .	29
Final Exam Comparisons . . . . .	30
Final Grade Comparisons . . . . .	30
Summary of Research Question 2 . . . . .	31
Student Course Evaluation . . . . .	31
Course Objectives . . . . .	31
Representative of Exams and Quizzes . . . . .	32
Summary of Course Evaluations . . . . .	32
V. CONCLUSIONS AND RECOMMENDATIONS . . . . .	36
Background . . . . .	36
Descriptive Information . . . . .	36
Grade Point Average of High School Students . . . . .	36
Conclusions . . . . .	36
Recommendations . . . . .	36
Agricultural Background . . . . .	37
Conclusions . . . . .	37
Recommendations . . . . .	37
Reason for Taking the Course . . . . .	37
Conclusions . . . . .	37
Recommendations . . . . .	37
Research Question 1 . . . . .	37

	Page
High School Students Who Passed/Failed . . . . .	37
Conclusions . . . . .	37
Recommendations . . . . .	37
Comparison of Pass/Fail High School Student Grade Point Averages (GPAs) . . . . .	38
Conclusions . . . . .	38
Recommendations . . . . .	38
Research Question 2 . . . . .	38
Summary of College/High School Student Grade Point Averages (GPAs) . . . . .	38
Conclusions . . . . .	38
Recommendations . . . . .	38
Summary of College/High School Student Performance . . .	38
Conclusions . . . . .	38
Recommendations . . . . .	38
Student Course Evaluation . . . . .	39
Course Objectives . . . . .	39
Conclusions . . . . .	39
Recommendations . . . . .	39
Summary . . . . .	39
Major Findings . . . . .	40
Major Conclusions . . . . .	41
Implications . . . . .	41
REFERENCES . . . . .	43
APPENDIX . . . . .	46

## LIST OF TABLES

Table	Page
1. Concurrent Enrollment Program Between Hartnell Community College and Salinas Unified High School District in California . . . . .	15
2. Syracuse University Project Advance Program . . . . .	16
3. Grade Level and Number of High School Participants . . . . .	23
4. Grade Level and Number of College Participants . . . . .	23
5. High School GPA of College and Concurrent Enrollment Participants . . . . .	25
6. Agricultural Background of College/High School Students in "Introduction to Agricultural Plant Science". . . . .	26
7. Reason for Taking "Introduction to Agricultural Plant Science" . . . . .	26
8. High School Students Who Passed/Failed at the Level of 70% . . . . .	27
9. Comparison of Pass/Fail High School Student Grade Point Averages (GPAs) . . . . .	28
10. Summary of College/High School Student Grade Point Averages (GPAs) . . . . .	29
11. Summary of College/High School Student Quiz Averages . . . . .	30
12. Summary of College/High School Student Exam 1 Averages . . . . .	31
13. Summary of College/High School Student Exam 2 Averages . . . . .	32
14. Summary of College/High School Student Final Exam Averages . . . . .	33
15. Summary of Student Final Grade Averages . . . . .	34
16. High School Student Course Evaluation Course Objectives . . . . .	35
17. High School Student Course Evaluation Representative of Exams and Quizzes . . . . .	35

## ABSTRACT

The Feasibility of Concurrent Enrollment of High School  
Students in College-Level Introductory Plant Science

by

Gregory H. Egan, Master of Science  
Utah State University, 1989

Major Professor: Dr. Weldon S. Sleight  
Department: Agricultural Education

The purpose of this study was to test the feasibility of allowing concurrent enrollment in the College of Agriculture to selected high schools in the state of Utah. "Introduction to Agricultural Plant Science" (Plant Science 100) was the course being tested. A purposive sampling technique was used to identify four vocational agriculture programs to participate. There were 86 high school students in the study and 38 college students who took the course on campus at Utah State University.

In this study, 47.7% of the high school students passed the course with a 70% average or above. Comparisons between high school and college student performance showed a marked difference in percentage points accumulated on exams and the final, with the college students performing more consistently.

(55 pages)



CHAPTER I  
INTRODUCTION

Background

Vocational agriculture programs have offered instruction to agricultural production-oriented students since the Smith Hughes Act was enacted in 1917, which established vocational agricultural classes in the high schools. Programs in vocational agriculture are based on current state, community, and student needs (Boyle, 1981). The ability of agricultural, business, and industry leaders to accommodate technological change is a major factor in the success of their operations. Vocational agriculture courses must adapt to change and bridge the gap between high schools and community colleges/universities if students are to be encouraged to continue their careers. Successful vocational agriculture programs not only encourage students to continue their agricultural education beyond high school but provide, for students who do not wish to continue their education, the basic competence and skills to enter productive entry-level jobs.

Enrollment in vocational agricultural programs has declined. The reasons for this decline are not completely understood, and several factors may affect student enrollment. Phelps and Hughes (1986) noted that vocational education support has faltered: "National studies have failed to include a substantive analysis of issues related to education for work and vocational education" (p. 52). They noted that vocational education must seek "funding opportunities for new model demonstration programs for high technology, applied research on basic skills

instruction in vocational education, and other equally important efforts" (Phelps & Hughes, 1986, p. 52).

#### Future Trends

W. S. Sleight (personal communication, April 1, 1988) stated that "high school vocational agriculture programs are designed today for students going into production agriculture. Agriculture programs need to change their direction." Coulter, Stanton, and Goecker (1986) identify the following job opportunities that will be available to agricultural science graduates (with or without experience):

- More than 48,000 employment openings are projected annually in the United States for those trained in agriculture, natural resources, veterinary medicine, and other closely related fields;
- Significant shortages of college-educated individuals are projected in the scientific and business specialties associated with the U.S. food and agricultural system;
- Through 1990, scientists, engineers, managers, sales representatives, and marketing specialists will account for three-fourths of the total annual U.S. employment openings.  
(p. 2)

Projected employment trends indicate that there will be significant shortages of trained personnel in several areas of agricultural science. Vocational agriculture programs must develop curriculums based on meeting these trends.

The National Farm Bureau Federation (1988) believes that vocational agriculture programs can prepare students for the future:

Numerous agriculture-related jobs are unfilled because trained college graduates are not available. High school vocational agriculture programs are essential to preparing students for college-level agricultural career training. We encourage the establishment of animal science and agronomy laboratories adjacent to high schools with an active agricultural program.  
(p. 25)

### Statement of Problem

The implications of the decline in enrollment in vocational agriculture programs have triggered concern among agricultural administrators in high schools and colleges/universities. From the review of literature, three significant problems have been identified:

1. Vocational agriculture programs are suffering from an image problem (W. S. Sleight, personal communication, April 1, 1988).
  - A. Traditional agriculture classes have offered production-oriented curriculums geared to students who live or work on farms.
  - B. Upon graduation from high school, vocational agriculture students have been placed in entry-level positions with little emphasis placed upon further education.
  - C. Vocational agriculture programs fail to receive credit for strengthening reading, math, and science skills.
  - D. Vocational agriculture programs fail to attract advanced placement students who take courses offered in college preparatory curriculums.
2. Vocational agriculture and other academic fields fail to coordinate curriculum with those of colleges/universities. Curriculum overlap occurs frequently, resulting in unnecessary duplication of effort (Boyer, 1983; Green, 1985; Kintzer, 1972; Kraska, 1980; W. S. Sleight, personal communication, April 1, 1988; Wagner, 1986; Watkins, 1983a).
3. Advanced placement students are not challenged by high school academic curriculums. High schools and colleges fail to

cooperate to develop courses that will alleviate academic boredom (Cox & Daniel, 1983; DeLuca, 1978; Voorheis, 1979).

#### Specific Purpose

This study tested the feasibility of allowing concurrent enrollment (defined as a 100-series course in college that is taught to junior and senior high school students, either on or off the high school campus, by a college professor or by a high school teacher with the title of adjunct professor) in the College of Agriculture at Utah State University to selected high schools in the state of Utah. Students who successfully complete the course receive both high school and college credit for Plant Science 100, "Introduction to Agricultural Plant Science," taught during the fall quarter at Utah State University by Dr. William F. Campbell. Four teachers of vocational agriculture and their classes of 11th and 12th grade students were included in this study.

#### Research Questions

The basic research questions explored in this study were:

1. Whether or not students enrolled in vocational agriculture courses can achieve 70% or above in Plant Science 100, "Introduction to Agricultural Plant Science."
2. Whether or not students in vocational agriculture courses perform as well as college students in this course.

#### Limitations

Because a purposive sampling technique was used to select high school agriculture teachers and their classes, the students enrolled in

the four vocational agriculture programs studied may or may not be representative of all vocational agriculture students in the state of Utah.

Initiation of a new course involves unexpected format and time constraints. Some agricultural teachers were concerned that they would not be able to complete course requirements in the specified time. The graduate student helped teach three to four units in a seminar setting to those classes who needed assistance.

Agricultural teachers were given lecture notes and course objectives. However, it was discussed that some testing materials did not match course objectives established.

### Definition of Terms

#### Advanced Studies

Junior and senior high school students who have completed all related coursework in a particular area and who can take college preparation classes in the high school or at local college campuses.

#### Articulation

The transferability of skills learned in high school and college. Collaboration between high schools and colleges eases the transition.

#### Concurrent Enrollment

A 100-series course in college taught to junior and senior high school students, either on or off the high school campus, by a college professor or by a high school teacher with the title of adjunct professor. Students who successfully complete this course receive both high school and college credit.

"Introduction to Agricultural Plant  
Science" (Plant Science 100)

An introductory course for agriculture and non-agriculture majors fulfilling a general education requirement at Utah State University.

CHAPTER II  
REVIEW OF LITERATURE

Background

Vocational agriculture has been popular among agricultural production-oriented students for many years. Enrollment in these agricultural programs was relatively stable, but enrollment gradually declined in 1983, and the number of vocational agriculture students has since decreased dramatically. Is the enrollment decline due to increased graduation requirements, which discourage enrollment in these courses?

Production-oriented farms comprise less than 2% of the total workforce in America. Has the decline in the number of farms been responsible for the enrollment decline in agriculture programs, or, has enrollment declined because vocational agriculture programs have not attracted nonproduction-oriented students who prefer advanced placement? Answers to these and related questions will have a profound impact on vocational agriculture programs.

Phelps and Swan (1986) studied the influence of vocational education programs on high-achievement students. The study compared two groups of students with the same range of ability and competence who had enrolled in advanced placement courses. One group took a vocational education course and the other did not.

Twenty colleges and major universities were surveyed to determine which student would be more desirable. Seventeen colleges responded to the survey; most were critical of the training offered by vocational

education courses: "Occupational training at the high school level usually involves filing, and 'go for'-type activities. Leave the work experience to college winter breaks, and summers through organized programs" (Phelps & Swan, 1986, p. 196).

Others, however, note the parallels between vocational education programs and the mainstream academic curriculum. "Although students need access to both a comprehensive academic and vocational curriculum, schools often fail to realize that many basic reading, math, and science concepts are strengthened and reinforced in vocational programs" (Phelps & Hughes, 1986, p. 58).

Curriculum development in vocational agriculture programs can meet local, state, and community needs. Vocational education programs can accommodate changing technology and can update the curriculum accordingly (Phelps & Hughes, 1986). Boyer (1983), an advocate for excellence in education, strongly recommends increased participation by high school students in community-based educational experiences.

#### Articulation

Berejikian (1978) said articulation refers "to the community college's relationship with its feeder high schools" (p. 4). Several important concepts must be considered when coordinating high school courses with colleges. "Secondary education is on a continuum which is not necessarily smooth," Berejikian (1978, p. 2) noted. Curriculum articulation in vocational education requires a growing and ever-increasing need for "educational efficiency" (Kraska, 1980, p. 54). Educational efficiency may be described as the effective transfer of learning from one level to another with little duplication of efforts.



In other words, high schools and colleges must collaborate. Predicted trends indicate future directions. Kraska (1980) noted that "high school enrollments will continue to dwindle into the 1990's. The National Center for Education Statistics has predicted that in 1990 there will be 25 percent fewer secondary students than are now enrolled" (p. 54). If true, then, enrollment declines must be addressed in colleges as well as high schools.

The importance of establishing links between high schools and colleges is often overlooked. Community colleges often fail to recruit students from feeder high schools and place more stress on placing students in four-year institutions of higher education (Kintzer, 1972). Kintzer (1972) noted that high schools receive little help from the community colleges in curriculum development.

Curriculum articulation calls for competency-based instruction (Kraska, 1980), which identifies skills required to complete a specific task, such as landscaping a yard. Watkins (1983a) studied the relationship between secondary schools and institutions of higher education and recommended that "every college and university should establish a comprehensive partnership' with one or more high schools to help improve the quality of American secondary education" (p. 1). He also endorsed Boyer's (1983) contention that high schools should encourage collaborative efforts with community and state colleges.

This collaboration appears to be increasing. Boyer (1983) noted that "college and high school educators are showing interest in each other" (p. 252), which is in contrast to the earlier perceptions of Berejikian (1978): "Improvement of extension of articulation programs with feeder high schools is relatively low in the order of financial

priorities" (p. 4). Berejikian also detected little movement in establishing articulation programs in high schools and community colleges. Since 1978, however, research and development of concurrent programs have received greater emphasis as high schools and institutions of higher education have been faced with declining enrollments. Boyer (1983) stated that "secondary schools and colleges have a special obligation to break the bureaucratic barriers and develop flexible arrangements for students as they move from one level to another. Such arrangements include . . . 'university in the school' programs" (p. 255).

Articulation between local high schools and community colleges can markedly improve efficiency with the

. . . elimination of duplicated learning, better use of resources, increased student access to programs, challenging curricula, elimination of time loss for students, better trained students, a system for identifying student competencies, and improved community support for programs and institutions. (Green, 1985, p. 44)

Encouraging professors and teachers to coordinate curriculum design can reduce duplication of efforts (Wagner, 1986).

Kintzer (1972) noted:

Articulation in education is definitely a team process in a series of complex and interlocking formal relationships between schools. Willingness to compromise extreme positions and to tolerate the views of others is (sic) essential if transfer relationships between high schools and community colleges are to succeed. (p. 3)

Kraska (1980) summarized the benefits of the articulation program as follows:

- 1) Provides progress and transfer for students,
- 2) Overall program instructional improvement,
- 3) Encourage program distinctiveness,
- 4) Stimulate more research into employment needs and
- 5) Better serve individuals at various life stages. (p. 59)

W. S. Sleight (personal communication, April 1, 1988) said that the future of vocational agriculture courses depends upon the degree to which colleges of agriculture across the United States more fully utilize 100-level coursework in vocational agriculture curriculums. "Programs such as concurrent enrollment can upgrade curricula, limit duplication of instruction, and expose high school students to the vitality and excitement of agriculture."

#### Advanced Studies

"As restricted funds have caused a general retrenchment in our nation's colleges and universities, so, too, has this phenomenon affected high schools" (Voorheis, 1979, p. 305). Voorheis recommended that colleges and universities "fill this vacuum by offering selected courses for advanced high school students" (p. 305). Junior and senior high school students frequently confront an "intellectual slack time" where academic challenges cease to exist. Many seniors complain that they are bored because they have taken all the advanced courses available in their particular fields of interest. Others are frustrated with the pace and level of instruction and look forward to greater challenges. Some feel that they have little in common intellectually with high school peers (Cox & Daniel, 1983; DeLuca, 1978; Voorheis, 1979).

High schools find it increasingly difficult to provide academic challenges to advanced students. Concurrent enrollment programs can help eliminate academic boredom. Voorheis (1979) stated: "'Concurrent enrollment' gives advanced high school students the opportunity of doing

academic work at a college or university while simultaneously completing his or her high school studies" (p. 308).

DeLuca (1978) summarized the objectives and rationale of a concurrent enrollment program:

- 1) It offers high school students an opportunity for early enrollment in college.
- 2) High achievers can explore careers and opportunities in various fields.
- 3) Students can participate in highly developed lab settings.
- 4) Students are placed in a college environment with other freshmen.
- 5) Students are enrolled with part-time articulated status.
- 6) Students can be ready to receive an associate degree within one year following high school graduation. (p. 60)

A concurrent enrollment program should provide significant direction to prospective students (DeLuca, 1978). It allows students to evaluate a program before formal college commitment begins. High achievers and undecided high school seniors can begin career programs. The program stimulates interest in those who may not have planned to attend college and exposes high school students to a career-oriented program. It is important that the curriculum mirror current industry trends, however.

Concurrent enrollment seeks to "help qualified students move more rapidly through the school system with both intellectual excitement and appropriate academic development" (Cox & Daniel, 1983, p. 27). Concurrent enrollment does not depend upon the local school system to provide the advanced courses needed by students.

Watkins (1983b) identified institutions that were cooperatively participating in high school and college programs. These institutions included major universities such as Johns Hopkins University, Seattle

University, Syracuse University, the University of California at Berkeley, and Yale University.

In Utah, Governor Norman Bangertter endorsed concurrent enrollment by saying:

Concurrent enrollment is one of the most important educational ideas in Utah. It provides us with a way of providing increasingly quality education on current revenues. Most importantly, concurrent enrollment allows our youth to develop critical thinking and other academic skills during their high school years. Concurrent enrollment should be implemented in every school district and higher education campus in the state. I fully support this concept and the educators who are currently working to ensure its proper implementation. (Sleight, 1988)

#### Program Implementation

The following guidelines must be considered when implementing a concurrent enrollment program (Brossman, 1975; Cox & Daniel, 1983; Crews & Pierce, 1986; DeLuca, 1978):

- Develop a clear understanding concerning tuition and other costs.
  1. Students are responsible for instructional supplies, texts, uniforms, laboratory fees, insurance, and transportation.
- Arrange adequate counseling services at both the high school and college.
  1. Determine a student's maximum course load.
  2. Develop criteria for determining course load that include capacity for study, type and number of courses requested, and outside commitments.
- Determine whether the college can offer appropriate-level work.
- Develop flexible administrative arrangements to provide maximum benefit to the students.

- Criteria for admission should entail the following:
  1. A cumulative grade point average (GPA) of 3.0 (B) or above on a 4.0 scale.
  2. Combined Scholastic Aptitude Test (SAT) score of 900 or above.
  3. Recommendation by a high school counselor or principal.
  4. Junior or senior classification.
- The high school must inform students of concurrent enrollment program offerings.
- Community colleges and universities are responsible for guidelines, class schedules, and registration procedures.
- Only core classes should be taught, unless another need is identified.

The criteria outlined above will help colleges or high schools to examine the feasibility of collaborating in concurrent enrollment programs.

#### Significant Findings

Concurrent enrollment programs are becoming more important even though they have been the focus of relatively few studies. Preliminary findings from three major studies are reviewed.

The first study concerned a program between Hartnell Community College and Salinas Unified High School District in California that began in September of 1972 (Greaves, 1974). (See Table 1 for the statistics concerning this program.)

Of those who participated in the concurrent enrollment program, 41.5% attended four-year colleges or universities. Over 90% of the

Table 1

Concurrent Enrollment Program Between Hartnell Community College and  
Salinas Unified High School District in California

Statistics	1970-72 base period	1972-74 experimental
Number of participants	69	201
Number of college units earned	360	1,400
Average number of units earned per person	5	5
Grade point average per unit completed	---	2.88
Number of credit hours	19	85+

students enrolled in the program felt that it was an educational benefit and came reasonably close to or exceeded student expectations. Members of Hartnell's Coordinating Council subsequently reviewed their goals for the 1986-87 school year and reaffirmed their commitment to concurrent enrollment (Orton, 1986).

The Syracuse Project Advance Program has been the subject of numerous articles. This study involved 1,433 college seniors who participated in Project Advance (concurrent enrollment). (See Table 2.) The study concluded that "graduates of Syracuse University Project Advance who go on to college appear to be exceptionally stable and high-achieving" (Mercurio, Schwartz, & Oesterle, 1982, p. 5). Additional reports found that the performance of students who participated in the program and enrolled at other universities and colleges was above average.

Table 2

Syracuse University Project Advance Program

Statistics	1975-76 follow-up studies	1976-77 follow-up studies
Number in concurrent enrollment program	1,545	2,601
Percentage of respondents to survey	58%	61%
Percentage of respondents going to college	98%	98%
Percentage completing a college degree	95%	99%
Average letter grade throughout college	A - 28%	A - 25%
	B - 62%	B - 63%
	C - 9%	C - 12%
	D - 0%	D - 0%

Wolf and Geiger (1986) compared the perceptions of high school students who had participated in concurrent enrollment programs. The survey included the University of Dayton, Ohio State University, and the University of Utah. More than one-half (55%) of the students attended the same college in which they had been enrolled in concurrent enrollment. Commonly cited reasons for entering the program were to reduce boredom in high school (70.3%), to get a head start on college (70%), and to take courses not available in high school (37.7%). Students, parents, and counselors all agreed that the great strength of the program was exposure to college life. The program was also valued because it attempted to meet the needs of able students.

Thus, concurrent enrollment helps advanced students fulfill educational pursuits. Follow-up studies clearly show that students



involved in concurrent enrollment programs felt that the program met their needs and prepared them for higher education. Similar programs in vocational agriculture prepare young people for employment, whether immediately after high school or following graduation from an institution of higher education.

CHAPTER III  
METHODOLOGY

Population

The target population included all vocational agriculture students in the state of Utah. The study population was identified by a purposive sampling technique which included students enrolled in four vocational agriculture programs and their instructors in the state of Utah. The college students were enrolled in Plant Science 100 fall quarter 1988 at Utah State University. The four high school vocational agriculture programs included a small portion of 9th and 10th grade students (10.4%). The majority of students (89.6%) consisted of 11th and 12th graders.

Sampling Procedure

A purposive sampling technique identified four vocational agriculture teachers and their classes to participate in the study. Vocational agriculture teachers who attended a conference in June 1987 were asked to volunteer for a pilot study in concurrent enrollment based upon three potential offerings: Animal, Dairy, and Vet Sciences 111; Plant Science 100; and Ag Education 101 (Ag Mechanics). A list of volunteers was identified, and screening of potential programs was performed. Criteria used to screen potential volunteers included the following:

1. The teacher must have taught for a minimum of three years in the current program.

2. An educational inservice training meeting with the college professor was required for all teachers.
3. Teachers were to use the testing materials and curriculum verbatim or as close to the college course as possible.
4. Teachers were to receive a minimum of two visits by the college professor or graduate student responsible for this study.
5. The facilities available to the teacher must be adequate.

#### Program Recruitment

The major college professor responsible for initiation of this project scheduled meetings with all volunteers and their direct supervisor (principal and/or superintendent). Program objectives were discussed, and biology and chemistry classes were visited. The major professor helped recruit program offerings in each school. It was the responsibility of the vocational agriculture teacher to continue the recruitment process. A total of 86 students from the four high schools completed the course.

#### Data Collection

Students who completed the on-campus course "Introduction to Agricultural Plant Science" participated in a total of three 15-minute exams, two 1-hour exams, and one final (not comprehensive). Grades were based one-fourth on quiz scores, one-fourth on each hour exam, and one-fourth on the final. The same grading technique was used for the high school groups who participated in the study. The same tests were used for each of the quizzes, hour exams, and final. The high school vocational agriculture teachers received copies of the quizzes and hour

exams, but the final was kept by the college professor and distributed at the end of the quarter. Once the quizzes and/or hour exams were completed, the vocational agriculture teachers graded the test materials using a key developed by the college professor. Teachers returned copies of tests and test scores to the graduate assistant or college professor for review.

The final was given by the local county extension agent, then returned to the college professor to grade. The college professor then assigned the course grade.

#### Validation of the Study

The following procedures minimized variations among schools and teachers:

1. Testing materials were exactly the same as those given the college group.
2. The final exam was held at the University and was never returned to college students. The high school students had no access to the final exam prior to the examination.
3. The graduate student made a total of two visits to each school to listen to instruction and help the teacher where needed.
4. The final exam was proctored by the local county agent, and final exams were returned to the professor for grading.
5. The teachers participating in the course were required to attend a two-day inservice workshop to be updated on course content and methodology.

### Analysis

Data were analyzed with the aid of the VAX computer. Descriptive statistics (mean, median, frequency, and percentages) were used to assess student agricultural background, grade point averages, grade levels, and to categorize reasons for taking the course. Passing was defined as 70% average on tests. The performance of high school students was also compared to that of college students. The following tests were used to accomplish the stated objectives:

1. A 2 X 2 contingency table to determine the number of students who passed and failed the course.
2. A one-way analysis of variance was run with two treatments to determine significant differences between high school and college students.
3. Performance scores on the quizzes, hour exams, and final were correlated with GPA, grade level, agricultural background, and high school/college student comparisons on test performance.

CHAPTER IV  
RESULTS AND DISCUSSION

Background

Students from four selected high schools and college students enrolled in the course "Introduction to Agricultural Plant Science" (Plant Science 100) participated in the study. Student performance on quizzes, the first and second hour exams, and the final exam scores were compared. The total grade was used to determine students who passed with 70% correct responses. There were 86 high school students and 38 college students in the study.

Descriptive Information

The first section of the chapter describes students' background, the second section concerns students' performance, and the third section compares the performance of high school and college students (Research Question 2). A fourth section concerns high school students' evaluation of Plant Science 100.

Grade Level of High School  
Participants

This study involved high school students (Table 3) in 9th through 12th grades. Concurrent enrollment is designed exclusively for students in grades 11 and 12. A few students in grades 9 and 10 participated in this study because they were enrolled in the course when it started.

Table 3

Grade Level and Number of High School Participants

Grade categories in years	Number by year	Participant %
9	2	2.3
10	7	8.1
11	42	49.0
12	<u>35</u>	<u>40.6</u>
Total	86	100.0

Grade Level and Number of College Participants

As shown in Table 4, the majority of college students taking Plant Science 100 was freshmen and sophomores. Plant Science 100 is a prerequisite course to further studies in agricultural plant science. Some plant science students delay taking this course until their junior or senior year.

Table 4

Grade Level and Number of College Participants

Grade categories in years	Number by year	Participant %
13	12	31.5
14	15	39.5
15	5	13.2
16	<u>6</u>	<u>15.8</u>
Total	38	100.0

### High School GPA of College and Concurrent Enrollment Participants

Table 5 identifies the high school grade point average of all college and high school students participating in "Introduction to Plant Science." Most students in both groups had a GPA of 3.0 or above. Plant Science 100 was designed to offer advanced placement students a chance to receive college credit while receiving instruction in agricultural plant science.

### Agricultural Background

Four descriptive terms were used to identify agriculture background of college and high school students in Table 6. There were very few (9.1%) in the study that did not have any agricultural experience. Two-fifths of the college students (42.4%) had lived on a farm, and over 36.4% had worked on a farm. Almost 54% of the high school students had lived on a farm, and another 13% had experience working on a farm. A third of the high school students listed their vocational agricultural courses as their only source of agricultural experience, whereas only 12% of the college students did the same.

### Reason for Taking the Course

A total of 61 high school students (71%) took Plant Science 100 for college credit. The remaining 25 students (29%) took the course because they were already enrolled in vocational agriculture or had nothing else to take (Table 7).

### Summary of Descriptive Data

Thirty-eight college students and 86 students in four high schools took "Introduction to Agricultural Plant Science." Almost 80% of the



Table 5

High School GPA of College and Concurrent Enrollment Participants

High school GPA	Current high school students	%	College student high school GPA	%
1.50-1.69	1	1.2	0	0.0
1.70-1.89	1	1.2	1	2.6
1.90-2.09	0	0.0	2	5.3
2.10-2.29	3	3.5	0	0.0
2.30-2.49	2	2.3	5	13.2
2.50-2.69	6	7.0	1	2.6
2.70-2.89	6	7.0	4	10.5
2.90-3.09	15	17.4	8	21.1
3.10-3.29	10	11.6	5	13.2
3.30-3.49	12	14.0	2	5.3
3.50-3.69	8	9.3	3	7.8
3.70-3.89	13	15.1	2	5.3
3.90-4.00	5	5.8	1	2.6
Missing or no information	4	4.6	4	10.5
Total	86	100.0	38	100.0

Table 6

Agricultural Background of College/High School Students in "Introduction to Agricultural Plant Science"

Agricultural background description	College <u>N</u>	%	High school <u>N</u>	%
No ag background	3	9.1	0	0.0
Lived on family farm	14	42.4	46	53.5
Worked on farm	12	36.4	11	12.8
Vocational ag only	4	12.1	29	33.7
Total	33	100.0	86	100.0

Table 7

Reason for Taking "Introduction to Agricultural Plant Science"

Reason for taking	College group	% total	High school group	% total
For college credit	33	100.0	61	71.0
Other reasons	0	0.0	25	29.0
Total	33	100.0	86	100.0

total student population had high school GPA scores averaging over 3.0. There was no apparent relationship between agricultural background of high school and college students and GPA, quiz and/or test scores. Almost three-fourths of the high school students took the course for college credit.

Research Question 1Summary of Pass/Fail at 70% Level

As shown in Table 8, fewer than half of the 86 students enrolled in Plant Science 100 passed the course. Performance did not appear to vary by grade or group.

Table 8

High School Students Who Passed/Failed at the Level of 70%

Grade	<u>N</u>	% passed	% failed
9	2	50.0	50.0
10	7	57.1	42.9
11	42	42.9	57.1
12	<u>35</u>	51.4	48.6
Total	86	47.7	52.3

$p < .05$ .

Comparison of Pass/Fail Student  
Grade Point Averages (GPAs)

The GPA of students who passed the course was 3.51 compared to 2.93 for those who did not pass. As shown in Table 9, students with lower GPAs were significantly less likely to pass the course.

Summary of Research Question 1

Grade point average is an indicator of high school student performance in Plant Science 100. High school students who passed the course had a higher overall grade point average than those who did not.

Table 9

Comparison of Pass/Fail High School Student Grade Point Averages (GPAs)

Estimators	Students achieving 70% or above	Students not achieving 70% or above		
<u>N</u>	39	43		
Mean GPA	3.5100	2.9300		
<u>SD</u>	0.3074	0.5232		
Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	7.027	7.027	37.26
Within groups	80	15.088	0.189	
Total	81	22.115		

$p < .05$ .

Research Question 2

Research Question 2 concerns differences in the performance of high school and college students. Differences in GPA, quiz, Exam 1, Exam 2, final exam scores, and total grades are examined.

Grade Point Average

As shown in Table 10, the GPA of high school students was significantly higher than that of college students (3.20 vs. 2.96).

Quiz Comparisons

High school students performed similarly to university students on quizzes administered throughout the quarter (Table 11).

Table 10

Summary of College/High School Student Grade Point Averages (GPAs)

Estimators	College students	High school students		
<u>N</u>	34	82		
Mean GPA	2.9613	3.2042		
<u>SD</u>	0.5286	0.5225		
GPA scores missing	4	4		
Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	1.419	1.419	5.16
Within groups	<u>114</u>	<u>31.336</u>	0.275	
Total	115	32.755		

$p < .05$ .

Exam 1 Comparisons

Table 12 concerns the performance of high school and college students on Exam 1. College students scored significantly higher on this exam than the high school students (20.013 vs. 18.244). There were 25 possible points on this exam.

Exam 2 Comparisons

The average score of college students (20.026) was significantly higher than the average score of high school students (14.552) on Exam 2 (Table 13). The standard deviations indicate that the scores of high school students varied much more than the scores of college students.

Table 11

Summary of College/High School Student Quiz Averages

Estimators	College students	High school students		
<u>N</u>	38	86		
Mean	19.347	18.576		
<u>SD</u>	2.112	3.724		
Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	15.7	15.7	1.42
Within groups	<u>123</u>	<u>1357.8</u>	11.0	
Total	124	1373.5		

$p < .05.$

Final Exam Comparisons

As shown in Table 14, the average score of college students (20.428) was consistent with their previous scores. High school students performed somewhat better during the final exam. High school students were monitored by a proctor, and test questions were developed from course objectives.

Final Grade Comparisons

Table 15 compares the final grades for college and high school students. A one-way analysis of variance indicated that college students scored significantly higher than high school students. Standard deviations also indicate that the scores of college students varied less than the scores of high school students.

Table 12

Summary of College/High School Student Exam 1 Averages

Estimators	College students	High school students		
<u>N</u>	38	86		
Mean	20.013	18.244		
<u>SD</u>	1.924	4.953		
Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	82.8	82.8	4.53
Within groups	<u>123</u>	<u>2246.6</u>	18.3	
Total	124	2329.4		

$p < .05$ .

Summary of Research Question 2

College students performed more consistently on hour exams and the final. Both groups of students had similar scores on quizzes, but the average final grade of college students was significantly higher than that of high school students.

Student Course EvaluationCourse Objectives

Sixty-eight of the 86 high school students taking Plant Science 100 completed an evaluation form. More than half felt the course corresponded closely to the stated objectives. Fewer than half felt that the course failed to meet its stated objectives. Of those 68

Table 13

Summary of College/High School Student Exam 2 Averages

Estimators	College students	High school students		
<u>N</u>	38	86		
Mean	20.026	14.552		
<u>SD</u>	2.819	6.834		
Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	792.7	792.7	22.62
Within groups	<u>123</u>	<u>4310.7</u>	35.0	
Total	124	5103.4		

$p < .05$ .

students, 36 (or 52.9%) felt as if the course corresponded closely to clearly stated objectives (Table 16).

Representative of Exams and Quizzes

Half of the students completing an evaluation form felt the course was representative of exams and quizzes (Table 17).

Summary of Course Evaluations

The evaluations of students taking the course were somewhat mixed. Nearly 50% felt the course met their expectations and 50% felt the course had not met their expectations. Two items meriting attention on the student evaluation form were: (1) The course corresponds closely to clearly stated objectives; and (2) Exams are representative to



Table 14

Summary of College/High School Student Final Exam Averages

Estimators	College students		High school students	
<u>N</u>	38		86	
Mean	20.428		16.320	
<u>SD</u>	1.947		4.840	

  

Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	446.3	446.3	25.48
Within groups	<u>123</u>	<u>2154.8</u>	17.5	
Total	124	2601.1		

$p < .05.$

Table 15

Summary of Student Final Grade Averages

Estimators	College students		High school students	
<u>N</u>	38			86
Mean	79.83			67.69
<u>SD</u>	7.34			16.69

  

Source of variation	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>
Between groups	1	3894.0	3894.0	18.47
Within groups	<u>123</u>	<u>25941.0</u>	211.0	
Total	124	29835.0		

$p < .05.$

Table 16

High School Student Course Evaluation Course Objectives

Evaluation criteria	<u>N</u>	%
Course met desired objectives	36	52.9
Course did not meet objectives	31	45.5
Respondents answering not applicable	<u>1</u>	<u>1.6</u>
Total	68	100.0

Table 17

High School Student Course Evaluation Representative of Exams and Quizzes

Evaluation criteria	<u>N</u>	%
Course representative of exams and quizzes	34	49.3
Course not representative of exams and quizzes	33	47.8
Respondents answering not applicable	<u>2</u>	<u>2.9</u>
Total	69	100.0

assignments, materials, and lectures of the course. Students taking the course were somewhat mixed in their responses.

CHAPTER V  
CONCLUSIONS AND RECOMMENDATIONS

Background

Students from four selected high schools and one on-campus group provided the data for this study. "Introduction to Agricultural Plant Science" (Plant Science 100), taught on campus at Utah State University, was adapted for use in selected high school agriculture programs. Data comparisons were made for student performance on quizzes, the first and second hour exams, and final exam scores. Total grade comparisons were used to determine if students could pass at a suitable level of performance (70%). There were 86 high school students and 38 college students in the study.

Descriptive Information

Grade Point Average of High School  
Students

Conclusions. High school student GPAs ranged from 1.6 to 4.0. Transcripts of 82 of the high school students enrolled in the course were analyzed; 76.9% had a GPA of 3.0 or above.

High school students participating in Plant Science 100 had above-average GPAs.

Recommendations. A follow-up study should be conducted to determine the significance of GPA to student performance and final grade attainment.

### Agricultural Background

Conclusions. Most of the high school and college students enrolled in the course had at least some agricultural background. Only 9.1% of the college students had no agricultural experience. All vocational agriculture students had at least taken vocational agriculture, which was identified as some students' only source of experience.

Recommendations. Any student should be allowed to take Plant Science 100 in the 11th or 12th grade.

### Reason for Taking the Course

Conclusions. Almost two-thirds of the 86 high school students taking Plant Science 100 took it for credit.

Recommendations. Plant Science 100 should be used as a marketing tool to increase enrollment in vocational agriculture programs.

### Research Question 1

#### High School Students Who Passed/ Failed

Conclusions. Almost half of the high school students passed the course. There were 45 students, or 52.9%, from grades 9 through 12 who passed the course at the 70% level. No grade level performed significantly better than another.

Recommendations. Grade level was not a contributing factor to student performance. However, due to the size of the sample, further research should be performed to see if grade level may/may not be an indicator of student success.

Comparison of Pass/Fail High School  
Student Grade Point Averages (GPAs)

Conclusions. Students passing the course had an average GPA of 3.51, while students who failed had an average GPA of 2.93.

Recommendations. Further study should be conducted to determine if GPA is a good indicator of student performance. Tests and exams were not representative of course objectives; thus, GPA in this instance cannot measure a student's potential to pass or fail.

Research Question 2

Summary of College/High School  
Student Grade Point Averages  
(GPAs)

Conclusions. The average high school GPA of college students was 2.96, while average GPA of high school students was 3.20. However, since the college students did substantially better than the high school students, the lecture from the professor may have contained information on test questions not provided to high school agriculture teachers.

Recommendations. College and high school student GPA showed an inverse relationship based upon performance; therefore, further study should be conducted to determine why this was the case.

Summary of College/High School  
Student Performance

Conclusions. There was no significant difference between the overall quiz scores of college and high school students. There were, however, significant differences in the performance of high school and college students on the exams and the final test.

Recommendations. The reasons for the variation in student performance warrant further study. Teacher attitude and student

attitude/study skills should be evaluated to determine if they contributed to poor test performance. Curriculum design and teaching to objectives and testing written objectives should also be evaluated.

### Student Course Evaluation

#### Course Objectives

Conclusions. Of the 68 high school students who completed a course evaluation form, about half felt that the course corresponded closely to the course objectives. About half of the students also felt that the course was representative of exams and quizzes.

College students did not complete a course evaluation form.

Recommendations. With nearly half of the respondents feeling that the course was not representative in exams and quizzes given, it would be recommended that an analysis of tests, quizzes, and any other testing material be compared to the stated course objectives.

#### Summary

Although every effort was made to control the quality of instruction offered at the four high schools included in this study, it was apparent that the performance of the high school students was not completely explained by the variables examined in this study. For example, at one high school the average grade was 80%, higher than the average score of the college students enrolled in the course. The average score at the other high schools was slightly higher than 61%.

These results indicate that other factors not included in the design of this study affected the performance of high school students. Included among these factors are the enthusiasm and competence of the

instructors, variables that are difficult to assess at the initiation of a study of this type. The writer, as an investigator, visited each class, and it was evident that enthusiasm and competence of the instructor seemed to vary substantially. This may have had an effect on student performance. Any similar study of this type should more carefully screen the ability and enthusiasm of the potential instructors. Those who are not fully committed to the endeavor should not be encouraged to participate.

High school students' course evaluations are consistent with this hypothesis. Some students were satisfied with the course; others weren't. The high schools at which students' performance was lowest were also the high schools at which student evaluations were the most negative.

These findings clearly indicate the vital role of instructors in concurrent enrollment programs. They do not reflect any flaws in the underlying philosophy or value of concurrent enrollment programs. Although not a focus of this study, those students who performed well also apparently received the best instruction. Those students also gave the program its highest evaluations.

#### Major Findings

The major findings were as follows:

1. Less than half (47.1%) of the high school students passed the course with a 70% or above average.
2. High school students who passed the course with a 70% average or above had a grade point average of 3.51.



3. College students averaged 79.83, or a B-, and high school students averaged 67.69, or a D+.
4. Nearly half (48.5%) of the students who completed the course evaluation felt that the course did not measure the objectives with representative exams and quizzes.

#### Major Conclusions

1. Fewer than one-half of the high school students who participated in Plant Science 100 passed the course.
2. High school students who passed the course had an average grade point of 3.51.
3. College student performance in Plant Science 100 was above average, while the average performance of high school students was not (average scores were less than 70%).
4. High school students taking Plant Science 100 demonstrated clear differences in their evaluation of the course. About half of those completing evaluations felt the course met its stated objectives and half did not. There was a similar difference of opinion concerning the representativeness of quizzes and exams.

#### Implications

This research project has shown that vocational agriculture teachers can use this course to attract advanced placement students, as it drew from AP biology classes. Plant Science 100, therefore, is a valuable recruitment tool for vocational agriculture programs. The

concurrent enrollment program will also undoubtedly improve the image of agriculture at the high school level.

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## APPENDIX

PLANT SCIENCE 100  
STUDENT INFORMATION SHEET

Name \_\_\_\_\_ Date \_\_\_\_\_

School \_\_\_\_\_ Address \_\_\_\_\_

Year in school 9 \_\_ 10 \_\_ 11 \_\_ 12 \_\_

Teacher \_\_\_\_\_ Class period 1 \_\_ 2 \_\_ 3 \_\_ 4 \_\_ 5 \_\_ 6 \_\_ 7 \_\_

Time of class \_\_\_\_\_ a.m. or p.m.

Directions: Answer the following questions completely so that the teacher and professor can learn more about you and your interests.

1. Please identify your agriculture background and experience.
2. Please list any plant science experience or background you may have.
3. What is(are) your career goal(s)? (If undecided, then identify things that you are interested in.)
4. What is(are) your basic reason(s) for taking this course?
5. Identify your interests and hobbies.

PLANT SCIENCE 100  
STUDENT INFORMATION SHEET

Name \_\_\_\_\_ Date \_\_\_\_\_  
School \_\_\_\_\_ Address \_\_\_\_\_  
Year in school \_\_\_\_\_ Days of week M \_\_\_ T \_\_\_ W \_\_\_ Th \_\_\_ F \_\_\_  
Professor \_\_\_\_\_ Time of class \_\_\_\_\_ a.m. or p.m.

Directions: Answer the following questions completely so that the professor can learn more about you and your interests.

1. Please identify your agriculture background and experience.
2. Please list any plant science experience or background you may have.
3. What is(are) your career goal(s)? (If undecided, then identify things that you are interested in.)
4. What is(are) your basic reason(s) for taking this course?
5. Identify your interests and hobbies.