Performance in General Chemistry

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A detailed comparison is made between the performance of students who are identified as being 'at-risk' (Math SAT $\leq$ 630) and those who are not at-risk (Math SAT > 630). CHEM 113/114 was first introduced in the Fall of 1997 to enhance the conceptual understanding and problem solving skills of students at-risk. The data spans the last four years to demonstrate the effect of intervention methods (CHEM 113) in comparison to the traditional lecture course (CHEM 115) or lecture/lab course (CHEM 117).

A. First Semester

Table A.I lists the average grades earned in the first semester of General Chemistry over the last five years. Great effort has been made to standardize the grades in CHEM 113/115/117 by examining student performance on common exam questions asked on all four tests and the final exam.

Table A.I GPA in First Semester General Chemistry

	1995	1996	1997	1998	1999*
CHEM 113			2.66	2.61	2.46
CHEM 115	2.73	2.63	2.72	2.90	2.85
CHEM 117	2.87	2.64	2.92	2.98	2.90
At-Risk students in all sections	2.30	2.10	2.56	2.59	
Non-at-Risk students in all sections	2.99	2.77	2.92	2.96	
Difference between At-risk and Non-at-risk	0.69	0.67	0.36	0.37	

* *New instructor for CHEM 113*

The completion rates for General Chemistry are calculated as the percentage of students enrolled in the course after the first week of class who successfully complete the course with a letter grade of C- or better.

Table A.II Completion Rates for First Semester General Chemistry

	1995	1996	1997	1998	1999*
CHEM 113			93.5%	91.2%	80.3%
CHEM 115	89.4%	85.8%	92.3%	95.1%	
CHEM 117	94.4%	87.0%	93.6%	95.6%	
At-Risk	81.3%	69.6%	91.5%	92.4%	
Non-at-Risk	96.8%	91.9%	94.4%	95.6%	

Detailed grade distributions over the last four years of first-semester General Chemistry are shown in Figs. A1 – A4.

Fig. A1

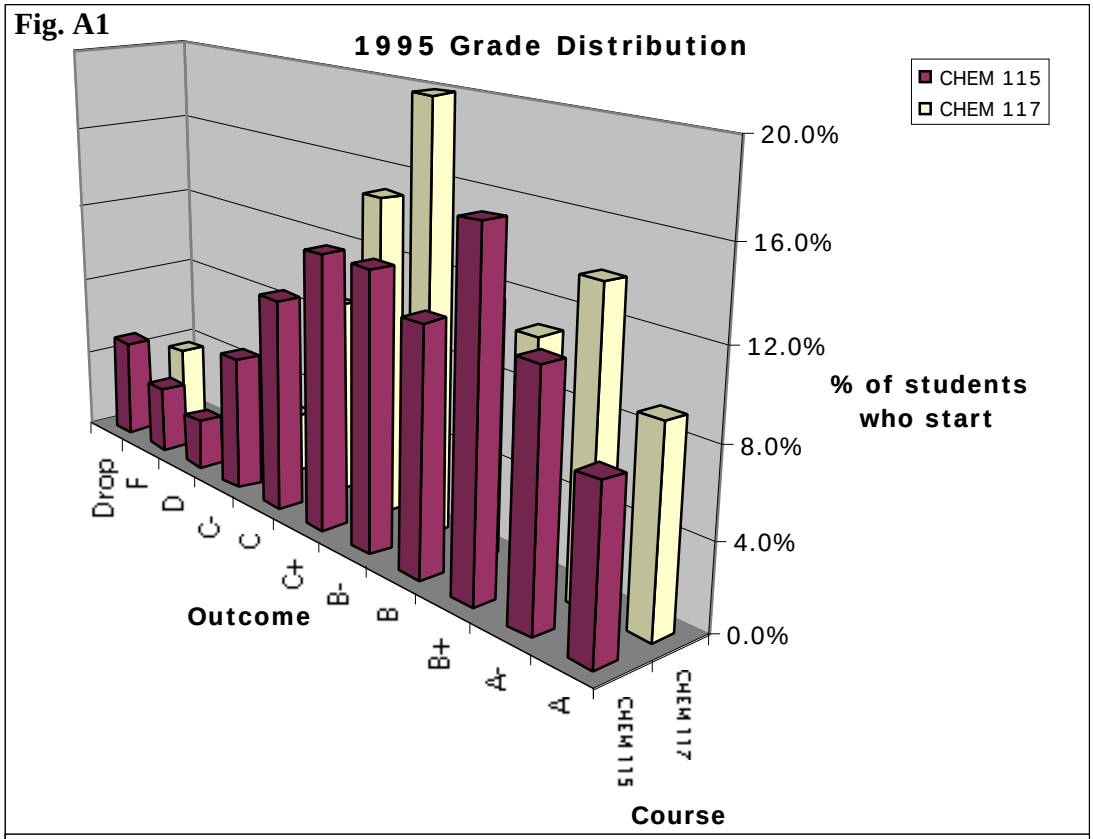

1995 Grade Distribution
CHEM 115
CHEM 117
20.0%
16.0%
12.0%
8.0%
4.0%
0.0%
% of students who start
Drop
F
D
C-
C
C+
B-
B
B+
A-
A
Outcome
CHEM 115
CHEM 117
Course

Fig. A2

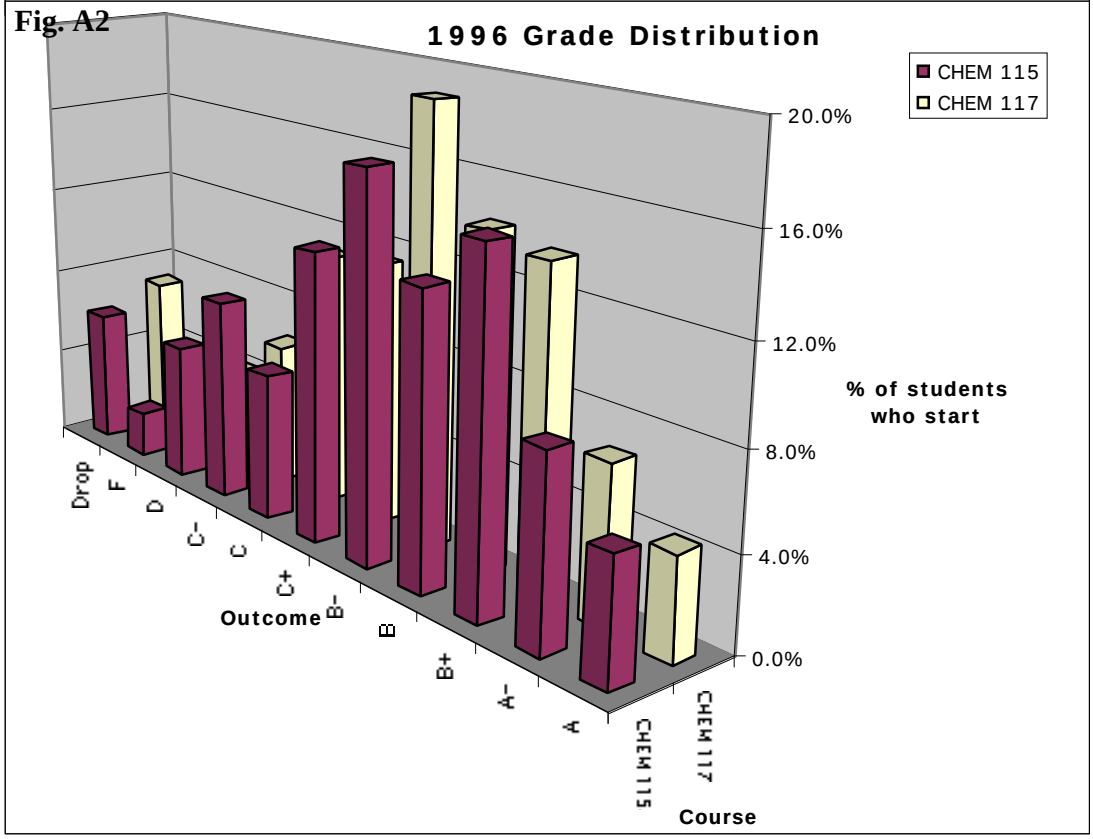

1996 Grade Distribution
CHEM 115
CHEM 117
20.0%
16.0%
12.0%
8.0%
4.0%
0.0%
% of students who start
Drop
F
D
C-
C
C+
B-
B
B+
A-
A
Outcome
CHEM 115
CHEM 117
Course

Fig. A3

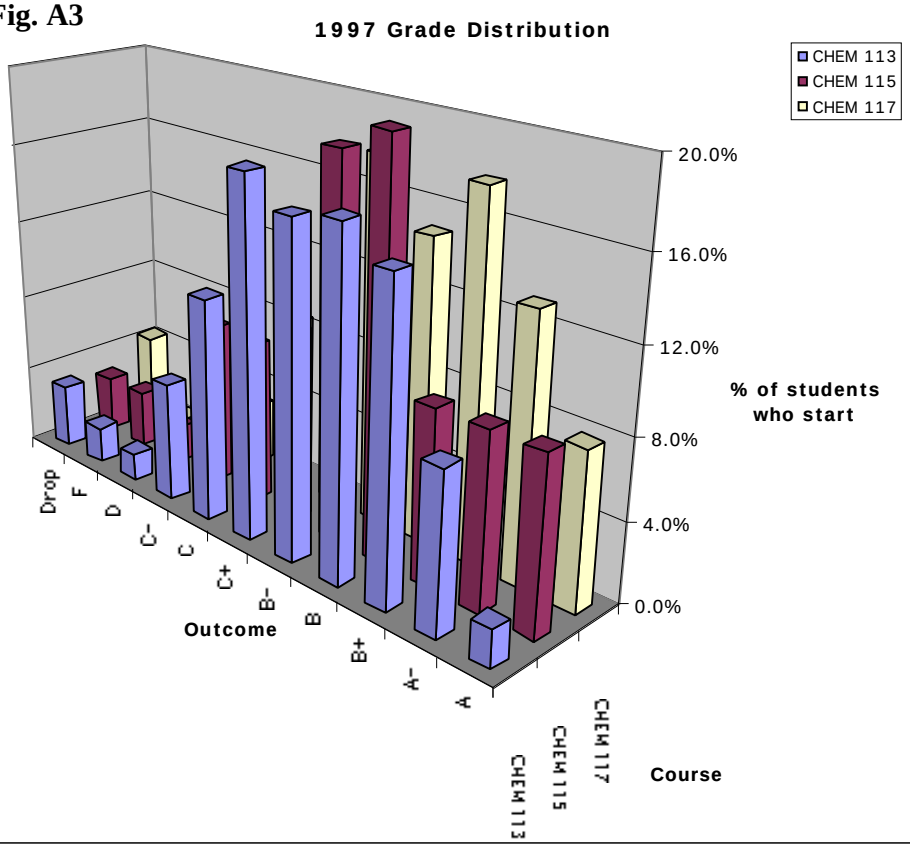
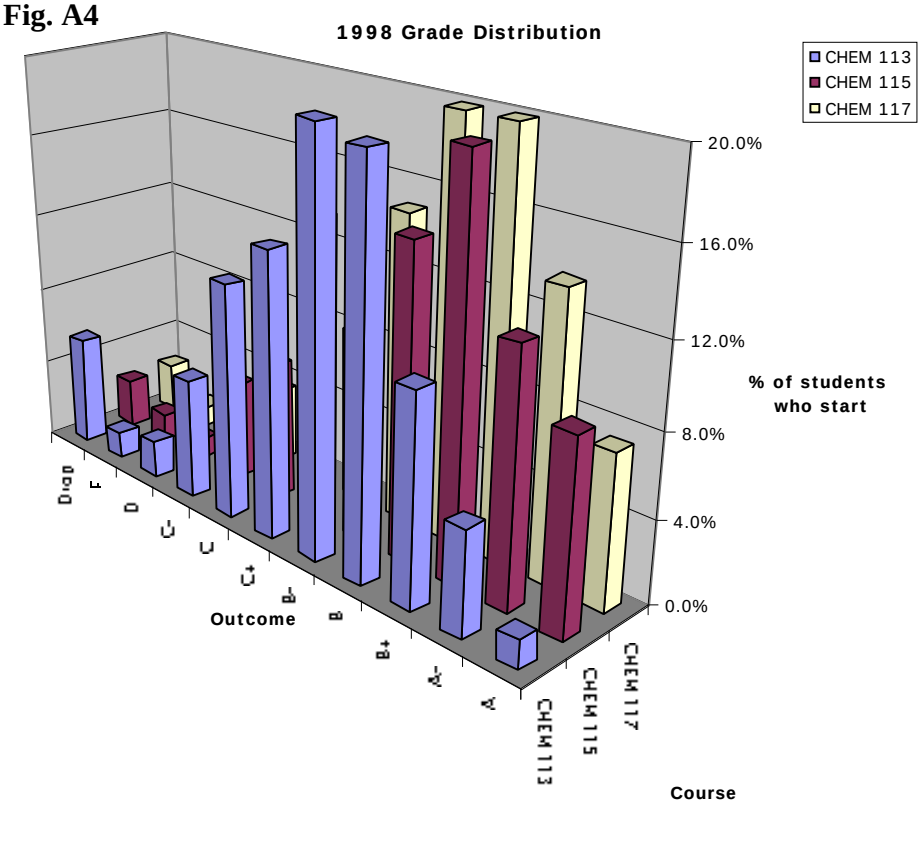

1997 Grade Distribution
CHEM 113
CHEM 115
CHEM 117
20.0%
16.0%
12.0%
8.0%
4.0%
0.0%
% of students who start
Drop
F
D
C-
C
C+
B-
B
B+
A-
A
Outcome
CHEM 113
CHEM 115
CHEM 117
Course

Fig. A4


1998 Grade Distribution
CHEM 113
CHEM 115
CHEM 117
20.0%
16.0%
12.0%
8.0%
4.0%
0.0%
% of students who start
Drop
F
D
C-
C
C+
B-
B
B+
A-
A
Outcome
CHEM 113
CHEM 115
CHEM 117
Course

If we focus on the at-risk students separately, the impact of CHEM 113 becomes most apparent in the reduced drop rate and the increased access to grades of B, B+, and A-. In contrast, the outcome for non-at-risk students has not changed dramatically over the last four years. Figures A.5 and A.6 illustrate these trends.

Fig. A5

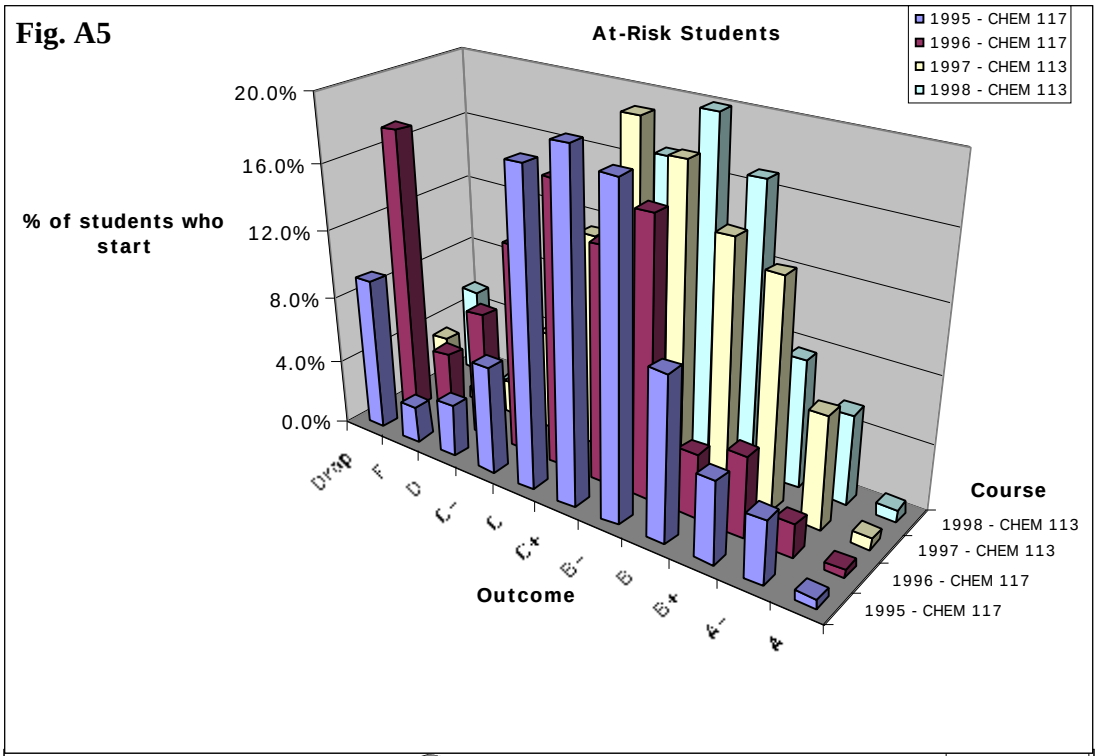
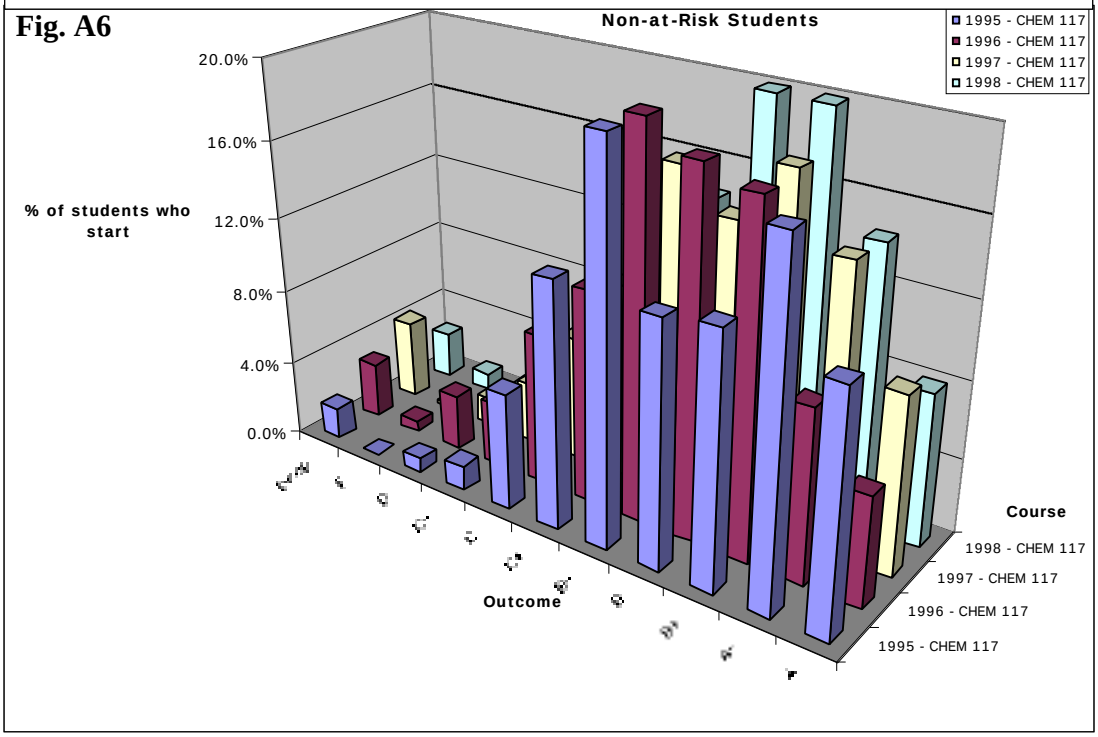


Fig. A6



B. Second Semester

CHEM 114 was introduced in the Spring of 1998 as a followup course to CHEM 113. The teaching methodologies were very similar to those employed in CHEM 113. Table BI shows the average grades earned in the second semester.

Table B.I GPA in Second Semester General Chemistry

	1996	1997	1998	1999
CHEM 114			2.54	2.69
CHEM 116	2.24	2.32	2.73	2.85
CHEM 118	2.61	2.62	2.82	2.91
At-Risk students in all sections	1.95	1.96	2.33	2.57
Non-at-Risk students in all sections	2.71	2.72	2.87	2.92
Difference between At-risk and Non-at-risk	0.76	0.76	0.54	0.35

Table B.II shows the completion rates for the second semester of General Chemistry. They are calculated as the percentage of students, enrolled after the first week of the second semester, who complete the course with a letter grade of C- or better.

Table B.II Completion Rates for Second Semester General Chemistry

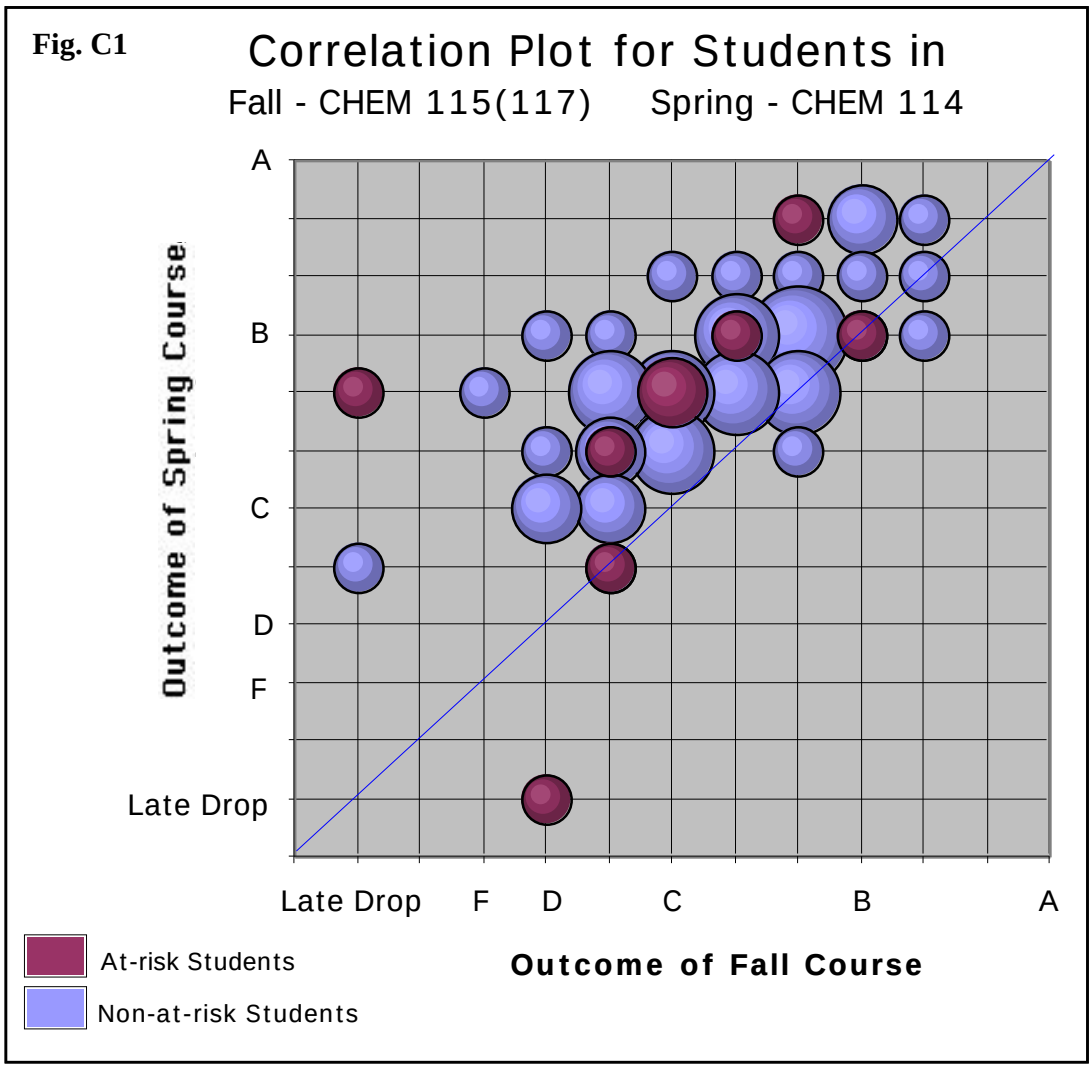
	1996	1997	1998	1999
CHEM 114			93.5%	96.9%
CHEM 116	79.1%	82.4%	92.9%	95.4%
CHEM 118	90.9%	89.2%	95.9%	96.8%
At-Risk	78.2%	71.8%	89.0%	94.0%
Non-at-Risk	92.2%	91.9%	96.7%	97.3%

Similar to the first semester data (Section A), a greater proportion of at-risk students completed the Spring semester of General Chemistry after CHEM 113/114 was introduced. Test performance showed improvement as well.

C. Grade Correlations

Most students continued in the same General Chemistry sequence in which they started, i.e. CHEM 113 -> 114, CHEM 117 –> 118, etc. However, some students elected to transfer after one semester to a different General Chemistry series. Virtually all students who transferred from the traditional Fall courses, CHEM 115 or CHEM 117, to CHEM 114 in the Spring showed marked improvement. Figure C1 is a bivariate scatter plot illustrating the correlation between Fall and Spring outcomes for F97/S98 and F98/S99. The size of each sphere is proportional to the number of students who simultaneously earned the corresponding Fall and Spring letter grades. The blue line represents equivalent outcomes in Fall and Spring. Data above the blue line indicate improvement.

Fig. C1



Students who elected to switch from CHEM 113 in the Fall to either CHEM 116 or CHEM 118 in the Spring did not fare so well. Figure C2 and C3 show the bivariate scatter plots for the small numbers who opted for these choices, respectively, in F97/S98 or F98/S99. Most of the students, who chose to switch out of CHEM 113, did so to free up time in their Spring schedule.

Fig. C2 Correlation Plot for Students in Fall - CHEM 113 Spring - CHEM 116

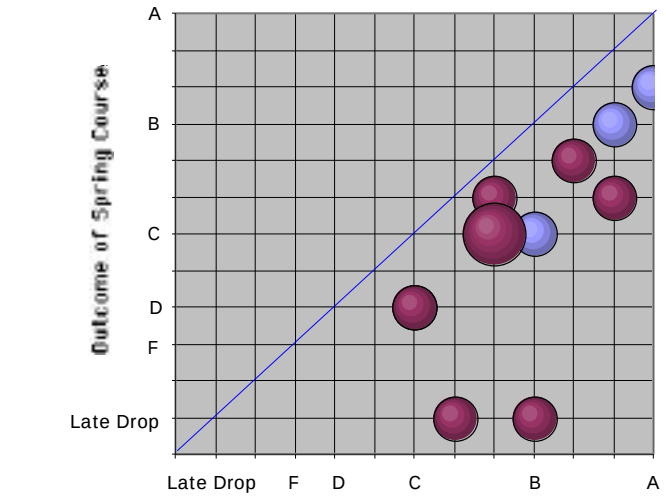
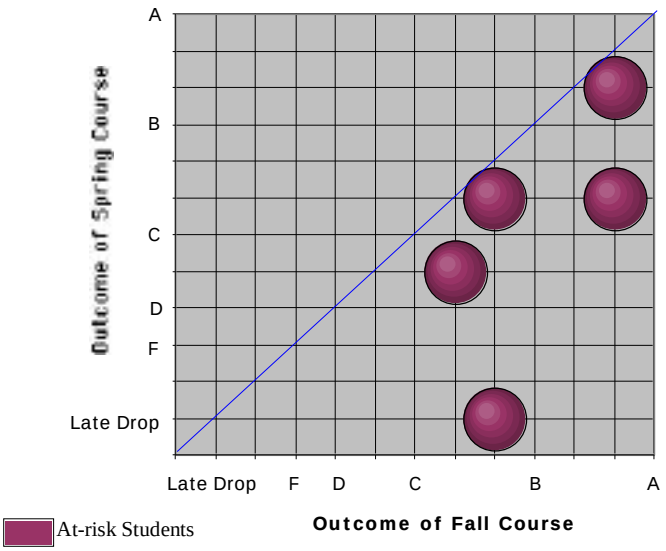


Fig. C3 Correlation Plot for Students in Fall - CHEM 113 Spring - CHEM 118



Course grade correlations between Fall and Spring were normal for both at-risk and non-at-risk students who completed the entire CHEM 113/114 sequence (Figs. C4 and C5).

Fig. C4

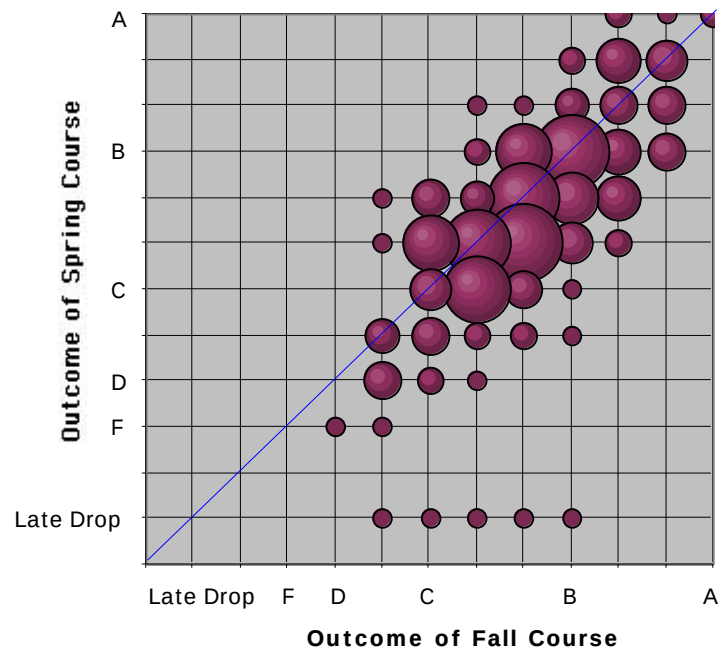
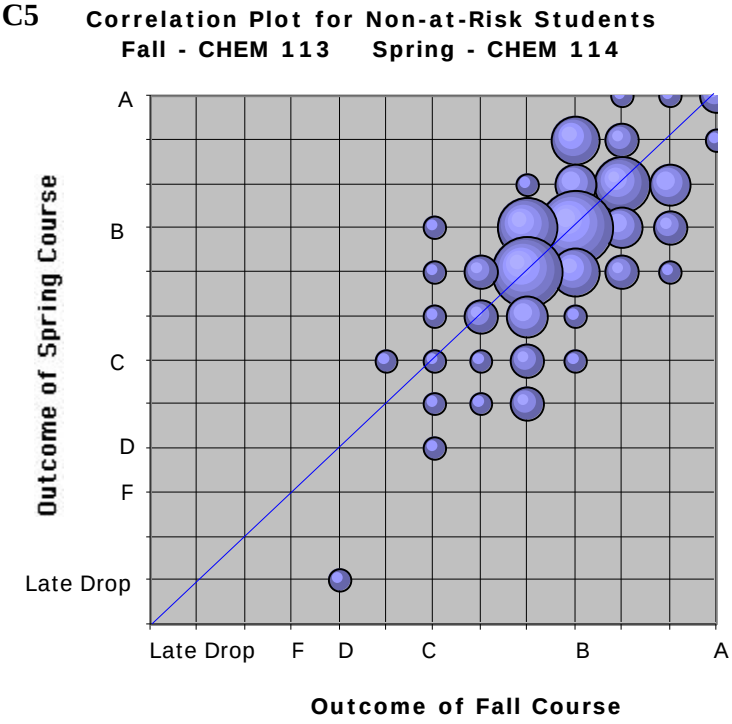


Fig. C5



Likewise, student performance in Fall and Spring were correlated for students who completed the CHEM 117/118 sequence (Figs. C6 and C7).

Fig. C6

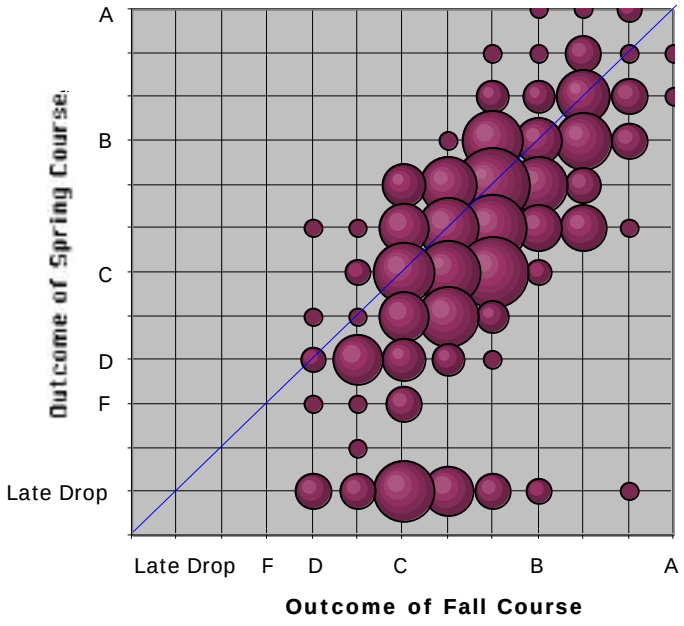
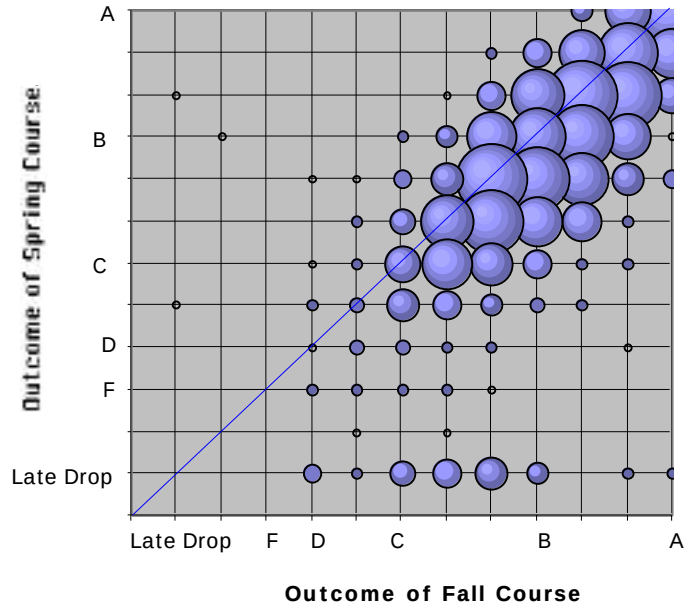


Fig. C7



D. Summary Statistics of Year-Long Course

The percentage of at-risk students who were successful in completing an entire year of General Chemistry with an average grade of C or better rose dramatically after CHEM 113/114 was introduced. The percentage of at-risk students who were able to achieve a B average or better doubled with the advent of CHEM 113/114. Figures D1 and D2 show these success rates averaged over all Gen. Chem. Sections (113, 114, 115, 116, 117, and 118).

Fig. D1

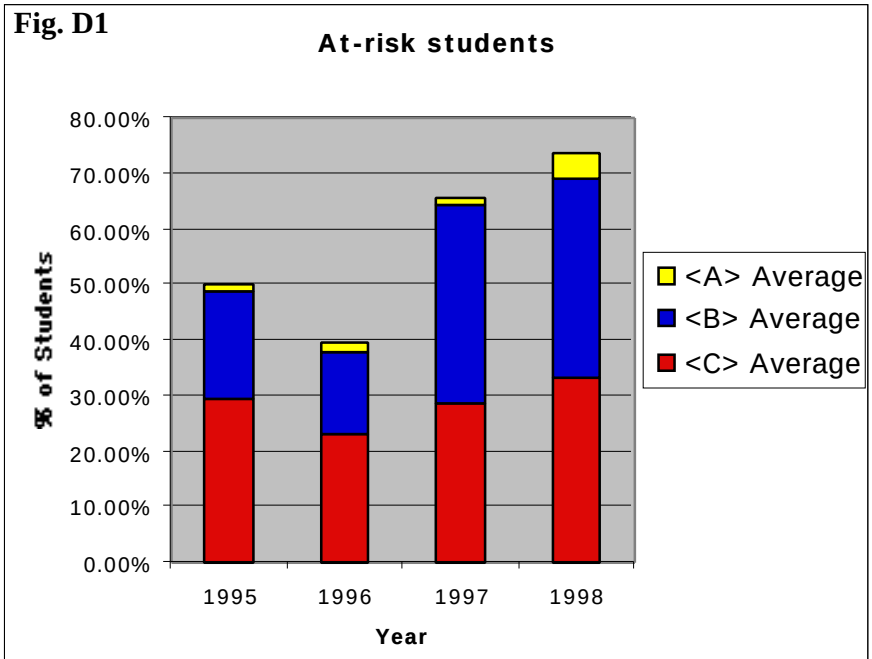
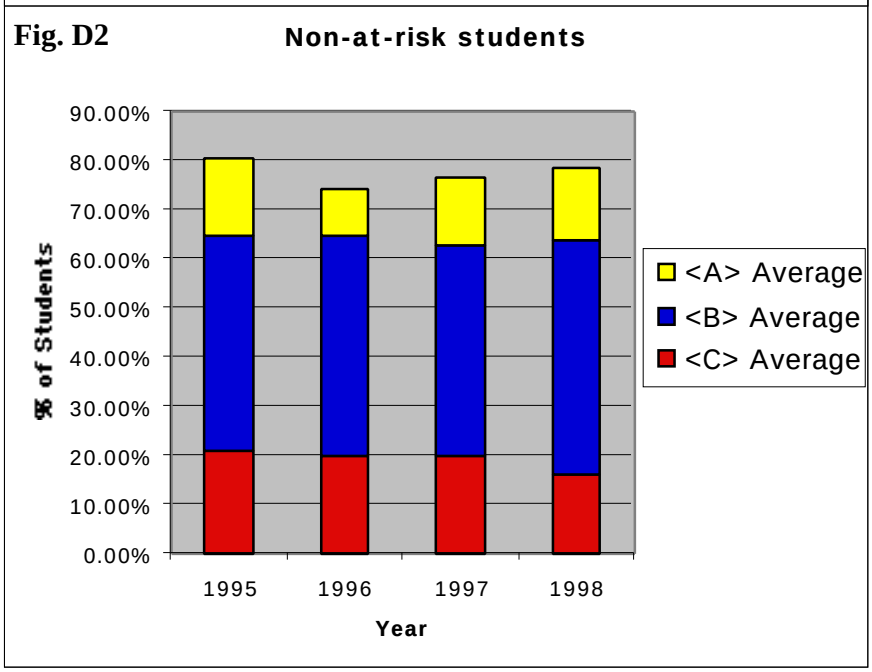


Fig. D2



The distributions of outcomes after an entire year are illustrated in Figs. D3 and D4. All sections of General Chemistry are grouped together, and the percentage reflects the fraction of students who start taking General Chemistry in the Fall. The grade reported reflects the average grade earned over two semesters of General Chemistry.

Fig. D3

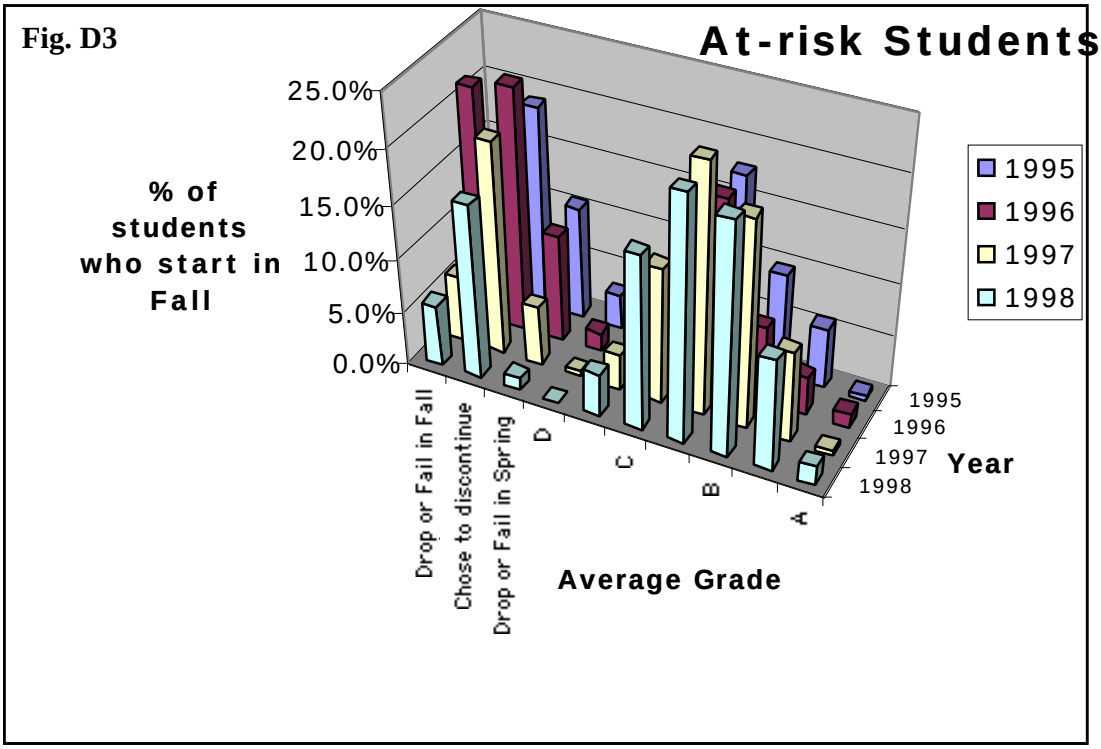


Fig. D4