Intensive Learning Versus Traditional Learning in Organic Chemistry

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Introduction

In the Summer Institute in Science and Mathematics (SISM), the traditional twenty-eight week, two semester sequence is condensed into two four-week terms in the summer. Classes meet five days a week (Monday-Friday), and three hours each day. This is the intensive format. Until now, there has been no comparative study on learning in the semester or quarter format vs. intensive learning in organic chemistry.

Many researchers have studied the relationship between class time and content mastery in the academic setting. According to Fisher and others (1980), time and learning is strongly related to academic achievement. Karweit (1984) and Walberg (1988) have studied the relationship between class time and learning. From their findings, class time is essential but not a primary factor for learning.

In 1992, Patricia Scott and Clifton Conrad carried out an extensive study on intensive and accelerated learning formats. According to their findings, there was little or no difference in academic achievement between the compressed and the traditional formats. They also acknowledged that educational outcomes were not diminished with the intensive course formats.

Wlodkowski and Westover (1999) reported on their findings on

accelerated courses as a learning format for adults. They reported that the accelerated format met the needs of adult students, and there was no difference in student performance in these accelerated courses as compared to the traditional courses. Their findings are in agreement with earlier research on accelerated compared to traditional course formats (Scott & Conrad, 1992).

Sometimes, the terms intensive and accelerated are used interchangeably when it comes to course formats. I would like to make the distinction for the purpose of the study presented here. The intensive learning format is different from an accelerated learning format. Accelerated courses are often structured in condensed formats that use weekend and evening classes, workplace programs, and distance learning. These courses are designed for students to do more work (to learn material) independently outside of class. In the intensive format, a semester course is condensed into a shorter time. Nothing is sacrificed with respect to the course material, and students are not expected to do more independent learning. The objectives of the courses are the same as those of the traditional formats. In order to understand how effective intensive courses in organic chemistry as a learning format are, a two-year study was conducted involving two institutions, Summer Institute in Science and Mathematics (intensive format) at Capital University and a nearby anonymous university (traditional format) in central Ohio.

Purpose of the Study

The purpose of this study is to examine: (1) the effectiveness of intensive course format for student learning; (2) the impact of this format on students' motivation for learning; and (3) content mastery.

Design for Comparing Formats

In this study, the same instructor taught organic chemistry in the traditional format at one university and the intensive format at SISM (Capital University), using the same text, the same syllabus (the same objectives), and the same exams. The study compares the final grades of students as well as anonymous course evaluation surveys.

Major Findings

How Effective (content mastery) is the Intensive Course?

In the traditional format, the instructor has only fifty minutes to lecture and interact with students three to four times a week. This

sometimes leaves the instructor with little or no time for innovative teaching (pedagogy or teaching methods) or time for students to work effectively together in class. The intensive format accommodates innovative teaching and learning opportunities due to three hour a day class time. As a result of this, students have more time to interact with peers and work effectively together and with the instructor. The data below addresses a frequently asked question, whether students in the intensive courses learn the material as well as students in the traditional courses as measured by course grades.

The study focuses on course grades due to the fact that colleges and universities use grades as one of the major components for admission and evaluation of student performance in the course. Some faculty argue that grades are not the best measure of learning, but they still use it in their courses to measure student learning outcome.

The content mastery of students was measured based on their total quiz and exam points. There was a difference between the two formats in the grading scale. In the intensive format, the passing grade in the course was 70% or higher, while in the traditional format, the passing grade was 60% or higher. This study looks at the percentage of students with grades of seventy 70% and above each year during the two-year period of the study. The results for the intensive format are: year one—90% of the students passed in the first session and 100% in the second session; year two—85.2% in the first session and 100% in the second session. For the traditional format, 58.3% of the students passed in the first semester and 54.5% in the second semester for the first year. In the second year, it was 42.9% in the first semester and 27.8% in the second semester (see Table 1). These results provide some evidence that the intensive format is an effective method for learning, and time has little or no effect on academic achievement.

Table 1. Learning Outcome (grades) by Type of Format

	SISM 2001 (intensive course)			Anonymous university 2000/2001 (traditional course)	
	1st Session	2nd Session		1st Semester	2nd Semester
Total # of students enrolled	20	17		24	11
Grading scale (%)					
A > 90	7	8	A > 85	6	2
B > 80	7	5	B > 72	8	4
C > 70	4	4	C > 60	6	2
D > 60	2	0	D > 50	4	3
F > 50	0	0	F > 40	0	0
% of students with 70% and above	90	100		58.3	54.5
	SISM 2002 (intensive course)			Anonymous university 2001/2002 (traditional course)	
	1st Session	2nd Session		1st Semester	2nd Semester
Total # of students enrolled	27	32		21	18
Grading scale (%)					
A > 90	2	6	A > 85	2	1
B > 80	12	16	B > 72	7	4
C > 70	9	10	C > 60	11	4
D > 60	4	0	D > 50	1	9
F > 50	0	0	F > 40	0	0
% of students with 70% and above	85.2	100		42.9	27.8

How Motivated are the Students?

There is no doubt that students in the intensive courses have a stronger motivation for success than their counterparts in the traditional courses. The intensive learning format is not for everyone, and as such, only talented and very motivated students usually enroll in these courses, particularly in organic chemistry. SISM students appreciate how the course was taught and they often make comments like, "The instructors are pushing us beyond what limits we thought we had." More than ninety percent of the students talked about the course having been "too demanding, yet interesting and fun". Students also stated that they have never experienced such a "wonderful" learning environment. When students develop positive attitudes, learning becomes their first priority, and they are focused to learn. Intensive-format students have more stamina and motivation for learning than students in the traditional format.

Students in the intensive format are more highly motivated than their counterparts in the traditional format. Some of the reasons for this increased motivation are that they met other students from varying backgrounds and institutions, and they receive personalized attention from professors and teaching assistants who are also focused on teaching and whose primary goal is educating the students. Intensive-format students' perception towards organic chemistry after the second week of classes is more positive than those of the traditional format and this might also improve student learning.

How Well Do Students Perform?

The method that was used to determine the effectiveness of the intensive format for students' learning and content mastery was by administering the nationally normalized and standardized American Chemical Society organic chemistry exam at the end of the two course sequence. These students achieved an average of 80^{th} percentile ranking in the exam. This result is good as compared to the national average of 68^{th} percentile. In the traditional format, this exam was not administered because the school did not use it. Given the similarity of the exams and quizzes in both formats, the performances of the students in the intensive format can be concluded to have surpassed those of the traditional format.

Conclusion

Based on the data presented here, it can be concluded that student

learning of organic chemistry in the intensive format is more effective than the traditional format. Possible explanations for this outcome might be due to the fact that the students in the intensive format have to focus only on one subject as compared to students in the traditional format where they have to deal with other courses.

Students in the intensive format strive for excellence because the format allows them to focus deeply on one subject in an environment which stimulates learning"plenty of class time, expert instructors, peer tutors"and the stakes are high"they want to be doctors, they are paying (higher tuition) a lot for the course, etc. Also in the intensive format, any student with a grade below "C" is not allowed to take the second course. This is one of the reasons for the 100 % passing rate in the second course. From the findings there is no doubt that the thinking skills of students in the intensive format improve more than the students in the traditional format.

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