P5. Offering Introductory Chemistry in a Learning Community versus a Stand-alone Course: Gains, Losses and Extras

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Abstract

At Spokane Falls Community College (SFCC), up to 350 students enroll in Chem. 100 (Survey of Chemistry) each year for various reasons. As a college-level, fully transferrable laboratory science course, Chem. 100 satisfies a degree requirement of the Associates of Arts and several vocational-technical programs. It also prepares students for more advanced chemistry courses. In the past five years, students at SFCC were offered an option to take Chem. 100 in conjunction with English Composition 101 (or 201, for those with more advanced writing skills) in a learning community (LC). This LC enrolls up to 45 students per section; they attend classes together, led by one instructor from each discipline, working collaboratively. The LC integrates traditional course content in both chemistry and English composition, with an added emphasis on personal and civil responsibilities to the environment. This report compares the chemistry portion of five LC sections versus traditional stand-alone Chem. 100 sections offered during the same period. Aspects compared include: course format, student profiles and completion rate, assessment strategies, curriculum issues, administrative / instructor issues, and some unexpected extras.

Table of Content (TOC)

Introduction

Learning communities (LCs) in various forms have become a widely accepted practice in higher education today *(1)*. The LCs offered at Spokane Falls Community College (SFCC) are similar to the "curricular" LCs described by the *Washington Center for Improvement of Undergraduate Education* as:"classes that are linked or clustered during an academic term, often around an interdisciplinary theme, and enroll a common cohort of students. *…* A learning community employs a variety of approaches … to build community among students, between students and their teachers, and among faculty members and disciplines." *(2)*

Both of us have taught Chem. 100 by itself many times for years. In the past five years, we separately offered a LC of Chem. 100 and English Composition with different English instructors. (RW offered it three times, in fall quarters 2002, 2003 and 2004. AB offered it twice, in spring quarters 2006 and 2007.) We will compare and summarize our experiences in this paper. (Back to TOC)

Background and Rationale

Chem. 100 is the most basic chemistry course offered at SFCC. It is quite popular among students, evidenced by the fact that the two or more sections offered each quarter quickly fill up to capacity soon after registration opens. Students take Chem. 100 for various reasons. Liberal arts majors take it to fulfill a laboratory science requirement. It is also a requirement for both the Fire Officer and the Fire Science Technology programs. Science majors consider Chem. 100 a launching pad or refresher in preparation for more advanced chemistry courses. This five-credit course involves seven hours of lecture and lab time per week.

Writing –to – Learn Chemistry

Our desire to teach Chem. 100 in a LC with English Composition originates from the writing - to- learn concept. Over three decades of educational research and actual practice have shown that writing is an effective learning tool in various disciplines *(3,4),* including chemistry*(5).* How exactly does writing help students learn chemistry? J. Kovac and D. W. Sherwood said: "Productive scholars have always known that 'writing is thinking'; … The best way to clarify thinking is to put early thoughts on paper for someone else to read." *(5)* N. VanOrden pointed out that writing assignments not only "encourage students to think about the chemical concepts", but are also useful to "find out if the students understand the chemical concepts, show students that chemical concepts can be very practical and help student improve their written communications in chemistry."*(6)* M. M. Cooper concurred that writing assignments "allow students to reflect upon the material, and the reflection process provides a clearer understanding of the subject matter. Writing about chemistry actively involves the student in the learning process - a prerequisite to a successful completion of the course." *(7)* H. Beall and J. Trimbur summarized the dominant themes of the sixth Annual Conference on Chemical Education in three points "the need to use writing as a way of charting thinking patterns and increasing understanding", "the use of writing to increase communication between teacher and among students", and "the desirability of adjusting the balance of chemistry teaching by emphasizing more on writing, and less on lecturing." *(8)* L. Chapman, originator of Calibrated Peer Review TM (CPR), states this in the CPR white paper: "By greatly enhancing the amount of writing that students do, CPR opens new avenues to learning that we educators have not explored. … students can learn to ask the critical questions, to doubt, to probe, to form mental models. But these issues are not just science issues, they hold true for history, sociology, geography, and more; indeed, they cut across our curricula." *(9)*

Indeed, the educational community has embraced the fact that writing helps students learn by "exploring ideas and making connections between them." *(10)* This is why most colleges and universities today offer "writing across the curriculum" programs, and many institutions further specify "writing-intensive" courses among graduation requirements. For example, there is a "five credit writing-intensive component" requirement for the Associate of Arts (A.A.) degree at SFCC. Any course, except English Composition, can qualify for the "W" designation if writing assignments (with the revision process as an integral part) account for more than 50% of course grade. One of us (RW) taught a stand-alone section of Chem. 100 with the "W" designation (Chem. 100^W), by designing a variety of writing assignments through online discussion forums, in-class and lab work, essay tests, plus a research paper that involves revisions and peer reviews *(11)*. The class went fairly well, even though no less than 5 students dropped the class immediately after finding out its "writing-intensive" feature. Other chemistry instructors who have incorporated formal writing assignments in their courses also reported similar sentiments of their students *(12,13)* . (Back to TOC)

Learning Community (LC) of Chemistry and English Composition

It seems to us that offering Chem. 100 in a LC with English Composition is a better way to implement the writing-to-learn concept than a stand-alone Chem. 100^W. On the one hand, we can design writing projects supported by the expertise of an English instructor to help students gain a more thorough understanding of chemistry concepts, and the Chem. 100 in this LC automatically qualifies for the "W" designation. On the other hand, relevant topics in chemistry help students hone writing skills. The English component of the LC includes both Eng. 101 and 201 (Advanced English Composition). Students with writing skills beyond 101 can earn credit for 201 by meeting more extensive and stringent writing criteria.

This LC also offers significant advantages from the students' point of view. Students can satisfy three A.A. degree requirements by completing this LC: five-credits each of "laboratory science" and "communication skills" distributions, plus the five credit "writing-intensive component". In addition, the five core practices of LC design: "community, integration, active learning, diversity and reflection, and assessment" *(1)*, promise them an enhanced learning experience. (Back to TOC)

Comparisons of LC and Stand-alone Chem. 100

Course Format Comparison:

Table 1 lists various aspects of the stand-alone Chem. 100 course format in comparison to that of the LC, with hyperlinked footnotes and three classroom pictures that provide more detail descriptions. In this comparison, we find that the LC scores a major "gain" over the stand-alone: more time-on-task is devoted to chemistry content in the LC than in stand-alone classes.

This gain is scored from two directions. One, more than 5 out of the weekly 9 hours class time in LC are regularly devoted to chemistry content and related activities, as described in the section on curriculum and assessment strategies and Table 3. In comparison, a stand-alone Chem. 100 generally has 4 hour-long lectures per week. Two, the SFCC English department schedules two portfolio reading / conference weeks for all Eng. 101 classes, one in mid-quarter and one at the end of the quarter. During these weeks, 101 classes are canceled anywhere from two days to the entire week, as composition instructors gather in whole day sessions to evaluate writing portfolios by a common rubric, and afterwards schedule individual conferences to discuss results with their own students. Well, since the LC students have another instructor available to be with them, they gain "chemistry class time" during these two weeks!

As a result of this gain in the LC setting, we can allow class time for students to "figure things out by themselves," instead of our usual experience of barely having time to "cover the material" in the stand-alone format. Again, the section on comparing curriculum and assessment strategies provides some concrete examples to support this point.

Table 1 – Course Format Comparison (Back to TOC)

Aspects Compared	Stand-alone Chem. 100	LC Chem. 100 + English Comp
	2 or 3 sections in fall, winter and	

Frequency of offering	spring quarter 1 section in summer quarter	1 section per year, fall or spring quarter since 2002
Enrollment cap	40 per section[1]	45 per section[1]
Class /lecture hours	4 hours per week[2]	9 hours per week[2]
Lab hours	3 hours per week[3]	3 hours per week[3,4]
Classroom / format	Sloped lecture hall with fixed chairs (Fig. 1)	Flat room with movable tables /chairs (Fig. 2) (Fig. 3)
Class format	Hour-long lectures, lab demonstrations, film clips, short in-class discussions, quizzes, etc.	Mix of short lectures, group work, seminars, hands-on exercises, presentations, field trips, etc.
Instructor Assignment	One chemistry instructor responsible for both "lecture" and "lab" components	Two instructors responsible for the "lecture" component; chemistry instructor alone responsible for the "lab" component[4].

Supplemental Information for Table 1

Figure 1 Stand-alone Chem 100. Lecture in session. (Back to Table 1)

Figure 2 Lecture room for LC with movable tables. (Back to Table 1)

Figure 3 LC Students work in groups during class. (Back to Table 1)

Student Profiles and Completion Rate Comparison (Back to TOC)

Table 2 summarizes student profile data in terms of age, sex, class standing, course completion rate and grades for stand-alone Chem. 100 versus LC. The first major difference is that the LC enrolled 25% *more first-year students* than the stand-alone; we consider this a "gain". One factor contributing to LC's higher percentage of first year students is that many of them enroll in the LC based on counselor recommendations during mandatory advising sessions. (In contrast, second year students register for courses on their own, and many of them register online. The SFCC online schedule planner does not direct students to look for chemistry courses in a LC. The student must know that the LC exists or be directed to it by an advisor.) The National Academic Advising Association endorses LCs as an "effective first-year intervention" because they create the sense of community beneficial to novice college students *(14)* . In fact, LC is "common practice" at approximately 62% of institutions included in a recent national survey conducted by the Policy Center of the First Year of College *(15).* In the sense of nurturing first year students, we found that our LC sections with 40% second year and 60% first year students did provide a balanced mix of experience levels that enriched the learning experience.

The LC strikes a significant "loss" in averaging 12% *lower* completion rate than that of the stand-alone. An interpretation for this loss could be that the "innovative" LC curriculum poses a greater challenge to students than the "regular" course work in stand-alone Chem. 100; the latter has well-known expectations, the former varies from year to year. Furthermore, the "active learning" in LC is more time-consuming with all the writing and preparation for seminars, presentations, group work, etc. This view is evidenced by student comments in course evaluations. Many described the LC as being "more advanced", "more than 'Chemistry for Dummies' ", "serious stuff", etc., and the LC course load being as if they were taking three courses: Chem. 100, English 101, plus an "environmental science course", instead of two.

In a second analysis of completion rates, we separated the data from the first- and second-year students within each course format, and found that there is a gap between the two groups of students, with the second- year group achieving higher completion rates than the first year group in both LC and stand-alone Chem. 100. However, the gap between the two groups is statistically significant only in the stand-alone format (80.3% versus 85.2%), but not in the LC format (70.7% versus 73.4%). This indicates that the LC format somehow helped first year students, so that they were able to achieve a similar completion rate as second year students. To verify this interpretation, we looked into completion rate data for a small sub-set of students in the stand-alone format (56 out of 1529) from two sections qualified as "writing-intensive Chem. 100". We found that the completion rate of this sub-set is lower than the total (75.9% versus 83.5%), and there is a greater gap between first- and second- year groups (64.8% versus 80.0%). This finding indicates that the "writing-intensive" factor, both in the stand-alone or the LC format, may have contributed to lowering completion rate. It also confirms that the LC format is a "gain" over the stand-alone format for first-year students in terms of "closing the gap" between completion rates.

Finally, grade comparisons between stand-alone Chem. 100 and the LC reveal statistically significant differences. The LC has *lower* average grades in terms of both cumulative college GPA and Chem. 100. Grade data from the sub-set of stand-alone, writing intensive Chem. 100 group are *lower* than the total stand-alone as well. The lower LC Chem. 100 grade may be a direct consequence of its higher percentage of "0.0" grades. The cumulative college GPA data may indicate that students who enrolled in our LC are performing at a lower level "across-the-board" when compared to students who enrolled in stand-alone Chem. 100. Or, it may be that the LC had negatively impacted students' overall GPA. No data is available for us to decipher between these two interpretations. We will begin to track pre-LC and post –LC college GPA data in future LC and stand-alone sections.

Table 2 Student Profile Comparison[†] (Back to TOC)

Aspects Compared	Stand-alone Chem. 100	LC Chem. 100 + English Comp
Age[1]	• Median age = 20.5 • Average age = 22.3	• Median age = 19.6 • Average age = 22.5
Sex[1]	• 796 female (52.1%) • 733 male (47.9%)	• 73 female (46.8%) • 83 male (53.2%)
Class Standing	• 517 first-year (33.8%) • 1012 second-year (66.2%)	• 92 first-year (59.0%) • 64 second-year (41.0%)
Completion rate[2]	• 1279 passed (83.5%) ▪ 41 writing-intensive (75.9%) o 415 of 1st year (80.3%) ▪ 13 writing intensive (68.4%) o 864 of 2nd year (85.2%) ▪ 28 writing intensive (80.0%)	• 112 of 156 passed (71.8%) o 65 of 1st year (70.7%) o 47 of 2nd year (73.4%)

	• 140 with 0.0 grade (9.3%) • 110 withdrew (7.2%)	• 26 with 0.0 grade (16.7%) • 18 withdrew (11.5%)
Average grade / GPA[3]	• 2.93 Cumulative College GPA o 2.69 writing-intensive • 2.62 grade in Chem. 100 o 2.14 writing-intensive	• 2.61 Cumulative College GPA • 2.30 grade in LC Chem. 100

Supplemental Information for Table 2

Curriculum and Assessment Strategies Comparison (Back to TOC)

Some striking differences in content delivery and assessment when comparing the LCs to stand-alone classes are outlined in Table 3. First of all, the LC curriculum emphasizes applications of chemistry to a much greater extent than that of the stand-alone. Each of our LC sections more or less took the *"Chemistry in Context" (16)* approach of establishing chemical principles "on a need-to-know basis within the contextual framework of significant social, political, economic, and ethical issues." This approach is a "gain" in terms of enhancing student interest and involvement, as the student is first presented with a topic relevant to his or her life and then introduced to the more abstract concepts of Chemistry. Even though they may still struggle with abstract concepts, the question of "why would I want to know this?" seldom comes up.

However, the LC may be a "loss" in terms of preparing students for advanced chemistry courses, which follow the same format as the stand-alone Chem. 100, albeit much more rigorous. We may point out that the conventional course format of extensive lectures and drilling exercises on basic skills tend to support recall and recognition of concepts, algorithmic understanding and mastery, whereas the LC employs teaching and learning activities that focus more on conceptual understanding and expression.

As to grading policy, the stand-alone Chem. 100 relies heavily on closed-book and timed tests, whereas LC depends on open-book, take-home and in-class group work, such as hands-on learning activity packets (LAP), seminars, projects, presentations, etc. This may be a "gain" for the LC, since the variety of assessment strategies let students demonstrate their knowledge in alternative ways and allow for different learning styles. They alleviate test-phobia, time-anxiety and avoid the practice of 'cramming' for exams and subsequently forgetting the material as soon as the test is over. Research projects and presentations, a major part of LC assessment, help prepare students to be life-long learners. Group work prepares them to work as members of a team, a skill they will likely need in their careers. Furthermore, though lab experience is similar for both stand-alone and LC, lab reports in the stand-alone classes are mostly 'fill-in the blank' whereas LCs made greater use of formal lab reports.

Table 3 Content Delivery and Assessment Comparison (Back to TOC)

Aspects Compared	**Stand-alone Chem. 100**	**LC Chem. 100 + English Comp**
Curriculum	• Introductory general chemistry • Applications – supplemental as time permits.	• Introductory chemistry, including some organic and biochem. • Applications - integral part or major theme.
	• *"Basic Chemistry"*, G. W.	• *"Fundamental Chemistry*

Textbook used[1]	Daub & W. S. Seese, Simon & Shuster (1996). • *"Introductory Chemistry"*, 2nd ed. N. J. Tro, Prentice Hall (2006)	*Concepts"* & "*Chemistry in the Environment"* Learning Activity Packets (LAPs)[2], M. R. Wang, Stipes (1999) & supplemental handouts. • Same text by N. J. Tro. • *"Chemistry in Context"*, 5th ed. ACS / McGraw Hill (2006)
Teaching & Learning activities	• Lectures – hour long with overhead transparencies or Power Point presentations, quick-time movies, lab demonstrations, etc. • In-class and take-home drill & practice worksheets on topics such as: unit conversions, nomenclature, balancing equations, stoichiometry, etc. • *World of Chemistry* video programs, Annenberg /CPB Project	• Lectures – same as stand-alone, but shorter than one hour. • Group work o Interactive / hands-on LAPs[2] o Seminars[3] o Learning Objectives (LOs)[4] • Field Trips and Projects[5] o Class project o Research project
Assessment strategies / Grading policy	• **50 – 60%** Tests - all closed-book, timed, with short answer, multiple-choice, fill-in-blank questions. o Three hour-long unit tests o One two-hour Final exam • **25 – 30%** Lab exercises • **15 – 20%** In-class & take-home work	• **15 – 20 %** Tests - format varied among LC sections: o Four LC sections had chapter tests and final exams that were similar to, but shorter than, those of stand-alone. o One LC section had no tests except a take-home final exam. • **20 – 25 %** Lab exercises • **25 – 35 %** Group work (LAP, LO, etc.) • **25 – 30%** Other Writing assignments[6]

Supplemental Information for Table 3

Administrative and Instructor Issues Comparison (Back to TOC)

Table 4 summarizes a comparison of stand-alone Chem. 100 and the LC in terms of administrative and instructor issues. Here LC sections post several losses. Some aspects of the loss are inherent in the LC approach. For examples: college administration must supply extra funds to contract two instructors for each course. Students attempting to add or drop the 10-credit LC face major adjustments in their fulltime standing and financial aid status. Other aspects of the loss are unique to our LC by pairing two very different disciplines. For example, the student management software system must be tweaked to link together four “course item numbers” (Chem. lecture and lab, English 101 and 201) to enroll students in the LC during registration, and then later enter separate course grades for Chem. 100 and either English 101or 201 in their transcripts. Also, English and Chemistry faculty belong to different workload categories, and the 3-hour per week arranged chemistry lab, though part of the chemistry course, is not part of the LC. It took a couple years of tweaking to settle on reasonable teaching contracts. However, LCs are not all losses from an administrative standpoint. Administration should support initiatives that allow faculty to be innovative and promote student success. The challenge is finding the balance with available resources.

The LC approach posts both “gains” and “losses” from an instructor's perspective. On the one hand, it is wonderful to work so closely with a colleague on a day to day basis. Besides exchanging teaching ideas, we provide feedback as “expert learners” in each other's subject matter. This interdisciplinary exposure is truly a valuable professional development experience. Another “gain” is the flexibility for innovation; the LC format with longer class times and same group of students make it easier to implement strategies not feasible in stand-alone classes.

On the other hand, LC instructors lose sole control in course design and implementation. Experience showed that two instructors may agree on a common syllabus at first, but differ later in the enforcement of policies set forth in the syllabus. For example, one may be strict about not accepting late assignments, but the other may make exceptions to the rule. As children in a family know how to work around one parent by going to the other, students do the same with their two instructors. Another “loss” for LC instructors is the huge time commitment involved in planning and on-going coordination with the teaching partner, reading papers and developing new course materials used in the LC. However, since each instructor receives compensation for both courses in the LC, extra workload should be expected.

Table 4 Administrative and Instructor Issues Comparison (Back to TOC)

Aspects Compared	Stand-alone Chem. 100	LC Chem. 100 + English Comp
Registration / scheduling	• Well established procedures for class scheduling, student registration, add-drop and grade records, etc. • Minor add-drop adjustment as a five-credit course.	• Implement modified procedures in all areas listed and trouble-shoot as numerous problems arise. • Major add-drop adjustment as a ten-credit course.
Workload[1] / Cost	• Normal cost: o Instructor contracted to teach one course. o Student-to-faculty ratio for a full section of 40 students = 26.7.	• Higher cost: o Each instructor contracted to teach both courses[1] in the LC. o Student-to-faculty ratio for a full section of 45 students = 18.0

	• Regular instructor workload as specified in the Master Contract.	• Each discipline belongs to a different workload category; special care needed to resolve contract issues.
Instructor Issues	• Sole control in course design and implementation of course syllabus • Regular time commitment • Discipline specific • limited options for curriculum innovation	• Shared control / lack of full control. • Extra time commitment [planning, grading, curriculum development]. • Interdisciplinary on a daily basis • More options for curriculum Innovation

Supplemental Information for Table 4

Some Unexpected Extras (Back to TOC)

The LC experience brought some "unexpected extras" for each of us. We will share the top two here.

RW did not expect the great pleasure derived from reading student essays. These often revealed students' struggles with chemistry, their ingenuity in using metaphors to relate chemistry concepts, and how they learned chemistry through writing. For example, one LC assigned an essay on how the factor-label method works. These essays were a pleasure to read because they frequently assure readers that the subject is "not that boring", "actually quite easy" or "useful in daily life", etc. They included metaphors such as: "going shopping" illustrated how factor-label method solves problems by first identifying the "given units" (grocery list) and "desired units" (items purchased); and "stepping stones across a stream" depicted the unit canceling scheme. A later assignment in the same LC asked students to select one of the papers assigned previously and describe their experience in writing it. Many chose the "factor-label" paper as their "most memorable writing assignment". One student wrote: "This paper was very valuable to me because I finally figured out how to do this method properly and I got an alright grade on the paper which is an added bonus." Another wrote: "In the beginning of this quarter, I was not exactly thrilled, to say the least, about being in a class where you had to write about chemistry. The thought of it made me nervous, but I found out it isn't that hard at all."

An "unexpected extra" to AB occurred when the Spring 07 LC students came up with the idea during a seminar that the final group writing project on "environmental issues based on the ACS *Chemistry in Context* textbook" should be expanded to addressing the issues identified in our community. The unexpected extra was not only for the fact that the students mobilized to take action on their own, but also for the quality and effectiveness of their actions. For example, one group investigated the possibility of implementing mandatory recycling in Spokane; this group set up interviews with members of City Council to discuss their ideas and contacted local experts from Spokane Solid Waste Management and Spokane Regional Solid Waste Systems who later came to class as speakers. Another group looked into ways to save energy and organized a campus-wide light bulb exchange after getting the local power company, Avista, to donate 500 compact fluorescent light bulbs. All groups worked enthusiastically and reported high degree of satisfaction with their work. The project greatly enriched the students' learning experience, as they acted on issues they felt strongly about and enjoyed ownership in the design of an assignment.

We both did not expect this LC to be so unusual and rare in chemical education, especially since "writing-to-learn" is such a well-known concept and common practice *(13).* Many colleagues we met during professional meetings and conferences seemed surprised to hear about pairing Chemistry and English courses together. Some questioned its feasibility. It was even more unexpected for some of our LC students to express the opinion that matching Chemistry with English is “odd” and it would “make more sense to put Chemistry and Math together”. One student said bluntly: “I don't think English should be mixed with chemistry. It's like mixing Math and PE”. This prompted us to reflect upon our LC experiences, detailing the gains and losses in a comparative study and report our findings to the chemical education community in this paper. (Back to TOC)

Conclusion

In summary, this paper compared our experiences in offering an introductory chemistry course: Chem. 100, in two formats: stand-alone and in a Learning Community (LC) with English Composition.

Overall, the LC scored the following “***gains”*** in comparison to the stand-alone format:

- Course format allows flexibility and more time-on-task for chemistry content.
- Enrolled higher percentage of first year students and helped them achieve similar completion rate as second year students.
- Afforded innovative teaching, learning and assessment strategies that focus on conceptual understanding, analysis, communication and team work.
- Allowed more integration of applications (environmental chemistry) in the curriculum.
- Excellent professional development for faculty in terms of interdisciplinary exposure and collegial collaboration.
- Produced unexpected impact on both personal and community levels.

The LC also posted some ***losses*** compared to the stand-alone format:

- Lower course completion rate – It was more intense / challenging than the stand-alone.
- Higher cost – It had a lower student-to-faculty ratio and higher faculty salary expense than the stand-alone.
- Complications in administrative procedures such as registration, workload calculations, etc.
- Huge time commitment required of the instructors with a loss of full control by each individual over course design and class management.

We anticipate reaping some benefits from this comparative study in future course offerings, both in the LC and the stand-alone formats. AB is scheduled to teach a LC section with the same English instructor again in spring quarter, 2008. She will focus on ways to reduce “losses” and maximize the “gains”. A primary goal is to address the lower completion rate / GPA issue by more formative assessments, such as: obtaining student profiles and pre-LC cumulative GPA data at the beginning of the course to identify at risk students, and a closer monitoring of student performance and intention to withdraw, etc. Summative assessment strategies such as tracking cumulative GPA and transfer rates of both stand-alone and LC sections should show us more clearly how LC impacts student success. It is also important to re-evaluate student workload in the LC in comparison to that of the stand-alone Chemistry and English courses. Activities that the students consider “fun”, such as field trips, will be retained. There will be more opportunities for student input in group projects, and more attention paid to strengthen the mutual support between first-year students and second-year students. The number of assigned LOs may be reduced and the content replaced with well-designed worksheets. Overall, we hope this LC will continue to win administrative support in future years as an option for students who wish to take introductory chemistry at SFCC.

Since stand-alone courses continue to be “main-stream” in our department and at SFCC, we have been adapting as much as possible, in the stand-alone settings, more active learning and assessment strategies developed in the LC approach. The “tools” gained in our LC endeavors are not “sitting on the shelf “, as we continue to explore “unusual paths” within the main-stream courses we teach. (Back to TOC)

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